

L'économie interne de l'Aristotélisme ne se trouve-t-elle pas modifiée depuis que les textes biologiques du Stagirite, soit un tiers du corpus restant, occupent à nouveau la place philosophique qui doit être la leur, celle que leur donnait Aristote lui-même ?

En confrontant leurs points de vue sur le problème, fondamental et redoutable, du «pont» entre l'épistémologie d'Aristote et sa pratique scientifique «réelle», des spécialistes des textes logico-métaphysiques et des spécialistes des textes biologiques aristotéliens apportent ici une contribution importante à la relecture contemporaine de l'œuvre du maître du Lycée.



The texts printed in this volume are the corrected transcripts of talks given at a colloquium held on the île d'Oléron in the summer of 1987. Aristotle's biological works make up nearly one third of Aristotelian writings which have come down to us. Recent research has restored to these texts the philosophical importance which they undoubtedly held for Aristotle himself.

How has this affected our views on the inner structure of Aristotle's philosophy? How are we to conceive of the linkage between Aristotle's epistemology and the way in which he in fact conducted his scientific enquiries? These are the questions addressed by the authors of this volume, who are either specialists of Aristotle's logical and metaphysical works or specialists of his biological writings. Their contributions mark an important development in the modern study of the Aristotelian corpus.

BIOLOGIE, LOGIQUE ET MÉTAPHYSIQUE CHEZ ARISTOTE

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PRIX : 370 F

ISBN 2-222-04403-0



Éditions du CNRS



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Couverture :

Figure du poisson nommé Vletif, espèce de Licorne de mer, extrait de A. Paré,
Œuvres complètes, Paris 1585.

Maquette réalisée par Roland Lowinger, Paris.

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Actes du Séminaire C.N.R.S. - N.S.F.
Oléron 28 juin - 3 juillet 1987

PUBLIÉS PAR
DANIEL DEVEREUX ET PIERRE PELLEGRIN

ÉDITIONS DU CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE
15, Quai Anatole France — 75007 PARIS
1990

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INTRODUCTION

Les essais ici rassemblés sont les versions revues des communications présentées à un séminaire organisé conjointement par le N.S.F. et le C.N.R.S. en juillet 1987 dans l'île d'Oléron¹. Cette rencontre, après celles de Williamstown (1983) et de Cambridge (1985), marquait la poursuite d'une entreprise, commencée il y a plusieurs années, de réévaluation théorique de la biologie d'Aristote, qui est à coup sûr l'un des événements herméneutiques principaux advenus récemment dans le champ des études aristotéliennes. Pourtant la rencontre d'Oléron a été fort différente des précédentes, et cette différence apparaît d'emblée dans la liste même des participants. Ont pris part aux discussions, en effet, pour moitié de gens qui sont considérés comme des spécialistes de la biologie d'Aristote, et donc, manière plus significative de voir les choses, pour moitié de gens qui ne le sont habituellement pas. Cette différence apparaît aussi dans la nature et, pourrait-on dire, l'atmosphère des débats que les textes rassemblés ici, bien qu'il s'agisse de versions révisées, rendent assez fidèlement.

Mais si la rencontre d'Oléron semble avoir été non pas, certes, conflictuelle, mais du moins beaucoup moins consensuelle que les précédentes (et nous n'avons rien fait, en publiant côte à côte les interventions et les commentaires et critiques qui leur ont été adressés, pour atténuer cette impression de contradiction), c'est peut-être aussi parce que la base commune des rencontres précédentes était trop fermement établie pour devoir être réaffirmée. Tous les participants du séminaire, en effet, étaient persuadés de l'intérêt spéculatif de la science, et notamment de la biologie, aristotéliennes. Tous étaient donc prêts à remettre en cause la séparation de fait qui avait cours jusqu'à une date

(1) Les communications de John M. Cooper et de Sarah W. Broadie avaient depuis été publiées par ailleurs, la première dans les *Proceedings of the Cambridge Philological Society* (n° 214, 1988), la seconde dans le numéro de l'hiver 1989 de la revue *Philosophical Topics* publiée par Christopher Hill à l'Université de l'Arkansas.

récente dans les études aristotéliennes entre l'étude des textes logiques et métaphysiques et celle des textes biologiques. Cet accord de principe, et comme tel un peu vide, ne suffit pourtant pas à résoudre l'un des problèmes les plus aigus que nous pose le corpus aristotélien, qui est celui des relations entre l'épistémologie et la métaphysique aristotéliennes d'un côté, et la science « en acte » telle qu'on la trouve dans certains des traités qui nous ont été conservés sous le nom d'Aristote de l'autre. Ainsi, pour reprendre deux exemples parmi les plus frappants, l'apodictique qui est, d'après les *Seconds analytiques*, caractéristique de la scientificité semble absente des écrits biologiques, et, alors que dans les livres centraux de la *Métaphysique* Aristote se préoccupe de déterminer si la matière des substances naturelles entre dans leur définition, le corpus biologique, contrairement à toute attente, semble ne pas se soucier de cette question. C'est sans doute cette absence de connexions évidentes entre les textes logico-métaphysiques et les textes scientifiques (et il faudrait ajouter : les textes éthiques, politiques, etc.) qui a le plus fait pour morceler l'approche du corpus aristotélien entre des spécialistes qui, peu à peu, avaient fini par ne plus guère communiquer entre eux.

A de tels problèmes, on le sait, des solutions diverses ont été proposées. Les uns ont soutenu que les traités scientifiques devaient être considérés comme les premiers pas d'une recherche qui n'avait pas encore trouvé de formalisation épistémologique adéquate, alors que d'autres, à l'inverse, pensent que la construction formelle des *Analytiques* a été élaborée par Aristote avant la mise en œuvre de son ambitieux programme de recherches biologiques, et que son expérience concrète de zoologiste lui a montré que son épistémologie était peut-être adaptée à des sciences de type mathématique mais pas à des investigations portant sur des phénomènes naturels. Mais il y a des hypothèses qui nous semblent plus importantes encore que celles que véhiculent de telles simulations chronologiques parce qu'elles portent sur la destination, et donc le statut, des différents traités d'Aristote. Dans un article justement fameux, Jonathan Barnes avait adopté une position radicale : l'apodictique telle que la construit l'*Organon* n'aurait pas eu une fonction heuristique mais pédagogique², tandis qu'à la fin de sa contribution au présent volume David Balme en arrive à douter qu'Aristote ait eu le moindre dessein définitoire dans ses traités biologiques. Si Balme a raison, l'une des connexions méthodologiques principales entre les traités logiques et les traités biologiques (ceux-ci mettant en œuvre une division définitoire élaborée dans les *Analytiques*)

(2) « Aristotle's Theory of Demonstration », d'abord publié en 1969 dans *Phronesis*, puis en version revue dans J. Barnes, M. Schofield, R. Sorabji (ed.), *Articles on Aristotle*, tome I (Londres, 1975).

se trouverait remise en cause. A l'inverse, des chercheurs comme James Lennox se sont efforcés de montrer, non sans force persuasive, qu'une lecture plus fine des textes montre une cohérence et une continuité plus grandes qu'il n'y paraît d'abord entre la pratique scientifique d'Aristote d'un côté et sa métaphysique et son épistémologie de l'autre.

Or si le problème crucial du pont que l'on doit, si on le peut, jeter entre les continents logico-métaphysique et scientifique³ du corpus aristotélien concerne les deux familles d'interprètes dont notre rencontre a permis la confrontation, aucune de ces familles n'est capable d'en approcher la solution sans l'aide de l'autre. Car aux « biologistes » qui clament depuis quelques années, et non sans raison, qu'il est devenu impossible de lire Aristote en ignorant son corpus biologique, les « logico-métaphysiciens » rappellent que ce corpus biologique, s'il veut assumer sa dignité scientifique enfin reconquise, doit faire face à des exigences théoriques très contraignantes. Que la confrontation des deux familles d'interprètes soit nécessaire et féconde, on peut en voir une preuve supplémentaire dès le début de ce recueil. Geoffrey Lloyd, en effet, dans sa salutaire tentative de mettre les aristotélisants en garde contre les illusions d'une unification conceptuelle et méthodologique trop rapide du corpus aristotélien, montre combien une telle unification est difficile si on entend conserver les exigences de la doctrine métaphysique de l'*ousia* dans notre lecture des textes biologiques. Nous avons donc ici une mise en garde d'un spécialiste de la biologie aristotélienne adressée à ses congénères. Or c'est dans un exposé comme celui de Michael Frede, exclusivement occupé de métaphysique, qu'on a pu aller chercher des armes contre Lloyd pour montrer qu'il n'y a pas de discordance majeure entre les emplois métaphysique et biologique de la notion d'*ousia*.

Ce problème de l'éventuelle construction d'un pont entre régions différentes de l'aristotélisme a orienté l'attention des participants du séminaire vers plusieurs questions.

Ainsi l'un des dilemmes bien connus des livres centraux de la *Métaphysique* tourne autour de la question de savoir si la forme d'une substance naturelle est universelle ou particulière. Dans la *Métaphysique* elle-même les partisans des deux interprétations n'ont pas manqué de trouver des arguments en leur faveur. Or si, comme nous le rappelions plus haut à l'occasion de la critique de Lloyd, le biologiste doit prendre en compte les exigences de la doctrine métaphysique de l'*ousia*, nous voyons aussi combien le connaisseur des textes biologiques est mieux armé qu'un autre pour s'y retrouver dans le labyrinthe du livre Z de la *Métaphysique*. Le débat n'est pas tranché, mais remarquablement

(3) C'est-à-dire surtout, mais pas seulement, biologique comme les contributions de Cynthia Freeland et de Mario Mignucci nous le rappellent opportunément.

approfondi par ce détour par la biologie. David Balme et John Cooper soutiennent que l'interprétation « particulariste » reçoit un renfort décisif de la théorie de la reproduction animale dans la *Génération des animaux* à travers son explication des ressemblances entre parents et enfants. Lloyd et Montgomery Furth, au contraire, offrent des arguments pour l'interprétation « universaliste » du statut de la forme.

De même pour le problème de l'individualité, Balme décèle dans les textes biologiques une indéniable tendance à définir plutôt le particulier. Mais cela ne va-t-il pas, comme le remarque Lloyd, contre la position constante d'Aristote dans ses écrits métaphysiques selon laquelle l'individuel est indéfinissable ? Où trouve-t-on la doctrine aristotélicienne « définitive » et où des interrogations et des recherches ? Balme et Lloyd s'opposent aussi sur une question voisine, qui est celle de la présence de la matière dans la définition des substances naturelles. L'analyse minutieuse des chapitres 10 et 11 du livre Z de la *Métaphysique* par M. Frede ainsi que le commentaire qu'en fait Donald Morrison permettent aussi de mieux cerner les enjeux de la controverse Balme-Lloyd.

Un autre ensemble de contributions concerne les rapports entre certains aspects de la méthode scientifique telle qu'elle est décrite dans ses ouvrages épistémologiques par Aristote et sa pratique effective dans les traités scientifiques. Ainsi David Charles fait-il le point des recherches qu'il a menées sur la question des types de définition, notamment dans les textes qui leurs sont consacrés dans les *Seconds analytiques* II, 8-10. Outre les éléments nouveaux qu'il apporte sur les étapes de l'investigation scientifique, il montre comment ces procédures épistémologiques se reflètent dans certaines de celles mises en œuvre dans l'*Histoire des animaux*. Ce dernier point suscite évidemment les remarques de James Lennox.

Durant ces dernières années, peut-être sous l'influence de l'article fameux de G. E. L. Owen « *Tithenai ta Phainomena* », on a pu noter un regain d'intérêt pour la conception aristotélicienne de la dialectique et pour ses rapports avec la science. Robert Bolton s'efforce de montrer qu'il y a chez Aristote deux sortes de dialectique dont l'une est destinée à l'investigation scientifique. Ce qui lui vaut les critiques convergentes de Jacques Brunschwig et de Daniel Devereux. L'un des problèmes principaux auquel se heurte celui qui examine le rôle scientifique de la dialectique aristotélicienne, c'est celui des « idées admises » (*endoxa*). Nous saurons beaucoup mieux comment la dialectique s'articule à la science si nous saisissons comment les *endoxa* sont utilisées dans les traités scientifiques. C'est par exemple ce que montre Cynthia Freeland à propos des *Météorologiques*, tant à propos des *endoxa* que des théories antérieures à celle d'Aristote.

Les autres contributions ne portent pas directement, ou du moins pas principalement, sur le pont entre épistémologie et science en acte, mais restent de l'un des côtés de ce pont. On verra qu'elles ne sont pourtant pas des pièces rapportées et qu'elles avaient leur place dans cette collection, qu'elles s'intéressent aux concepts de l'explication scientifique comme celles d'Aryeh Kosman et Françoise Zaslowsky, à la téléologie comme celle de Sarah Broadie, à la cosmologie comme celle d'Anthony Preus, ou au statut chez les vivants non humains du concept éthico-politique de *phronesis* (Jean-Louis Labarrière).

Enfin une place à part doit être faite à la contribution de René Thom. On sait l'importance d'Aristote dans la réflexion actuelle du père de la Théorie des Catastrophes⁴. La distinction entre homéomère et anoméomère, cruciale en biologie aristotélicienne, l'est également dans la machine explicative thomienne, comme cela apparaît dans cette contribution.

Telle qu'elle se présente cette collection d'essais témoigne de l'état présent des études aristotéliennes. Plus précisément elle se situe entre deux consensus. Le premier, qui est derrière nous, porte sur le caractère spéculatif de la science, et notamment de la biologie, aristotéliennes, comme on l'a dit plus haut. Le second consensus est à venir, bien que nul ne sache s'il adviendra jamais. Il faudrait en effet que les aristotélisants se mettent d'accord sur un certain nombre de thèses et/ou d'hypothèses relatives au problème des relations entre les exposés épistémologiques d'Aristote sur ce qu'on pourrait appeler sa méthode scientifique et les procédures qu'il met en œuvre dans la réalité de ses recherches scientifiques. Cette interrogation sur le « pont » entre théorie et pratique de la science aristotélicienne n'est certes pas nouvelle. Mais c'est aujourd'hui seulement qu'elle peut être sérieusement envisagée, c'est-à-dire après qu'a été, sinon achevé, du moins bien engagé le mouvement de reconquête théorique du corpus scientifique aristotélicien. Les communications ici rassemblées montrent en tout cas que si sans armature épistémologique la biologie aristotélicienne est aveugle, sans les traités scientifiques, et principalement biologiques, la métaphysique et la logique d'Aristote restent largement vides.

Joan Kung, qui avait participé aux rencontres précédentes, se promettait de venir à Oléron. Elle est morte à un âge qui nous fait penser que la majeure partie de son œuvre était encore à venir. Nous avons beaucoup pensé à elle durant nos débats. David Balme, empêché de venir à Oléron pour des raisons familiales, heureuses puisqu'il

(4) Voir son dernier ouvrage : *Esquisse d'une Sémiophysique. Physique aristotélicienne et Théorie des Catastrophes*, Paris, 1988.

assistait au mariage de sa fille, a pris activement part à nos travaux en faisant connaître ses positions, tant par lettres que par l'intermédiaire de certains d'entre nous. Il ne verra pas ces actes. Perte irréparable de celui qui fut pour nous tous un maître et un ami.

Ce volume est dédié à leur mémoire.

Daniel DEVEREUX,
Pierre PELLEGRIN.

BIOLOGIE, LOGIQUE ET MÉTAPHYSIQUE
chez ARISTOTE
Séminaire CNRS-N.S.F., 1987
Éditions du CNRS, Paris, 1990.

ARISTOTLE'S ZOOLOGY AND HIS METAPHYSICS : THE STATUS QUAESTIONIS A CRITICAL REVIEW OF SOME RECENT THEORIES

GEOFFREY E. R. LLOYD

After many decades of comparative neglect, the zoological treatises of Aristotle have been the subject of a considerable resurgence of interest in the last dozen years.¹ It is now no longer a matter of a handful of specialists studying the finer details of Aristotle's descriptions of the reproduction of octopuses. A wide variety of scholars have come to see that the zoological works present rich materials to test theories and interpretations of Aristotle's thought on many fundamental issues, in metaphysics, in philosophy of science and in psychology especially. But if the scholars in question are united by the ambition to use the zoology to support readings of Aristotle's views on topics from causation to the philosophy of mind, they are anything but agreed on how the zoology itself should be interpreted or on what lessons are to be drawn from it for the interpretation of Aristotle's thought more generally. That no simple orthodoxy has emerged as the result of that resurgence of interest in the zoology is neither surprising nor in itself cause for concern. After all a fair divergence of interpretation in the field can be a sign of lively ongoing debate. Yet that hardly characterises the current situation in some areas of the study of zoology, which border, rather, on a state of interpretative anarchy. My aim in this paper is first and foremost to spell out some of the implications — for the interpretation of Aristotle's thought in general — of some of the theses that have been based on a study of the zoology or that have

(1) Recent books include Kullmann 1974, Preus 1975, Pellegrin 1982 (trans. 1986), ed. Gotthelf 1985, edd. Gotthelf and Lennox 1987, Furth 1988.

been advocated by appealing to ideas and theories claimed to be in evidence in his work in that area.

As I shall devote most of what I have to say to a critical review of some of the 'findings' claimed in recent work in the zoology, it is only right and proper for me to preface my remarks with some recognition of the positive aspects of that resurgence of interest. First that very resurgence itself should be applauded (even if one may feel that the results so far obtained are disappointing: compare developmental studies when they first became the rage). At least one may say that it is now going to be very much more difficult than before for anyone to get away with strategic generalisations about Aristotle's philosophising that do *not* pay some attention to his work on the study of animals.

Then secondly, among the points emerging from recent work that command widespread (if not universal) agreement are the following: first, following pioneering work by David Balme, Pierre Pellegrin has shown how the use of the terms *genos*, *eidos* and *analogia* is context — or level — relative.² While in certain prominent, programmatic passages in the *PA* and elsewhere Aristotle stratifies *analogia*, *genos*, *eidos* as if he were interested in fixing their taxonomic levels, his use elsewhere and in general runs counter to any such strategic interest. That in practice *genos* and *eidos* each designate classes of very varying extension is, now, abundantly clear. Nor, secondly, can there be any serious doubt over the absence of any Linnaean-style taxonomy from Aristotle's zoology — though, on the question of whether Aristotle had any interest in *eventually* supplying a comprehensive classification of animals, recidivists like myself still resist drawing the conclusion that that *further* question must *also* receive an emphatic negative answer. But for my present purposes it is enough to record unanimity on the minimum fact that a *comprehensive systematic* classification of animals proceeding *from* the highest groups *via* their principal divisions to end with the *infimae* species all clearly identified is nowhere to be found.³ Third, Jim Lennox has won much support for his view that an interest in securing the widest class to which a property belongs provides *one* important link between the principles set out in the *Posterior Analytics* and the practice in the zoology: though again that is far from

(2) See Balme's reference to Pellegrin at Balme 1987b p. 72 n. 2 and 79 n. 8, and Lennox at Lennox 1987a p. 100. At Pellegrin 1985 p. 105 there is the further claim that 'the word *ousia*, like *genos* and *eidos*, designates realities of a variable level of generality': but in this area, on the question of substance, Pellegrin's views are more questionable, as I shall argue below.

(3) Even in 1961 and 1968 when I optimistically suggested that developments can be traced in Aristotle's procedures in classifying animals, I spoke only of the broad classification into greatest kinds being generally clear with some minor reservations (Lloyd 1961, p. 73) and in Lloyd 1968 p. 86 I explicitly denied that a definitive, systematic classification of animals is to be found in the zoological works.

saying, of course, that there is general agreement on other aspects of the question of the applicability of the former to the latter, let alone on the extent of their actual application. Quite the contrary: I shall be returning to that.

However while on certain points concrete (if sometimes negative) results have been obtained, on others the impression that recent work creates is one of continuing radical divergence on fundamental issues — of interpretative anarchy, as I put it. Due allowance should be made, to be sure, for the tentativeness with which some interpretations have been proposed. It is a feature of much of the new work in zoology that the scholars in question draw attention to the need for further work. It seems to be *de rigueur* in this field not just to revise opinions maintained some time ago, but to do so with regard to positions published no more than a couple of years back, even, at the limit, of positions in work as yet unpublished but forthcoming. David Balme himself, without a doubt the doyen of English-speaking scholars who have attempted to take Aristotle's zoology seriously, has modified his earlier published views on the authenticity of parts of *HA*, on its relationship with the rest of the zoology, on teleology, and on classification.⁴ Flexibility, tentativeness, anti-dogmatism are all laudable qualities: but when, as so often in this area at the present time, we are faced with a bewildering variety of hypotheses, the urgent need is to spell out and explore their implications: the chief task then becomes one of evaluation. It is with that end in view that I wish to scrutinise critically some of the interpretative suggestions currently in the field. If the tone of my comments appears particularly critical, I would plead that the highest compliment than can be paid to an interpretation is to submit it to the severest testing.

Let me begin with one of the results proposed by Pierre Pellegrin from his careful, pioneering and immensely influential studies. Already in his *La Classification des animaux chez Aristote* he spoke of one of the

(4) Thus on questions of authenticity at Balme 1987a p. 16, and on teleology at Balme 1987c p. 285 n. 33. Compare also the different formulations used in different versions of his influential 1961 article. In the original version he wrote (Balme 1961, p. 212) 'it is difficult to imagine that the Stagirite had abandoned or lost interest in the classification of animals, to which he attaches such importance and such careful rules in the *Organon* and *De Part. Anim. I.*' When the paper was reprinted in 1975, he put it (p. 192) 'This (the collection of differences) would have yielded the explanatory classification of animals demanded by his rules of division, in which the genus is no arbitrary class of common characters but a statement of the potentialities which its species actualise.' But in the 1987 reprint (Balme 1987b) all talk of an eventual classification of animals has disappeared. The statement that 'the *HA* is a collection and preliminary analysis of the *differences* between animals' (Balme 1987b p. 88, see also p. 80, original emphasis, and cf. Balme 1975, p. 192) is *not* followed by any reference to a possible explanatory classification.

central themes of the zoology in terms of what he dubbed 'moriology'. In two recent papers⁵ he notes that many of his colleagues remain opposed to these views⁶ but he reiterates the fundamentals of his position and maybe goes even further on some points. Thus in the collective volume, *Philosophical Issues in Aristotle's Biology*, edited by Gotthelf and Lennox, he writes: 'I am convinced that the *moria* constitute the cardinal level of Aristotelian biology'.⁷ It is to *moria* (alone) that the correct division of a *genos* into *eide* can be applied. 'It is only when the conceptual schema *genos-eidos* is applied to *moria* that is must have recourse to all the "logical information" which it contains and that the division of the *genos* can be made according to contrary *eide*.' 'The division of the parts according to the conceptual schema *genos-eidos* is "more" a definitional division in the Aristotelian sense of the word than is the division of animal classes.' Nevertheless 'if it is to *moria* that the conceptual schema *genos-eidos* is applied most completely, it is to animal classes that it is applied the most explicitly.' But if there is a tension between these two view-points, something like a 'reconciliation' between the two fields of application is to be found — Pellegrin claims — in the famous passage in *Politics* IV, where (in his view) 'the schema is applied sometimes to animal classes, sometimes to *moria*, with the latter level being determinant since it is the conjunction of the *moria* which makes possible animal diversity'.⁸

Moreover in his contribution to the Balme Festschrift Pellegrin tackles questions to do with the notion of substance. There the thesis of the paper is, as its title suggests, that in a certain sense (which he specifies) Aristotle's zoology is a 'zoology without species', but in the process Pellegrin argues not just that 'for the biologist... [the] strategic level is that of the *moria*',⁹ but further that 'in Aristotelian biology the *ousiai*, in the primary and strong sense, are the *moria*'.¹⁰ Again the *Politics* passage is discussed and the explanation of Aristotle's evident interest there in the definition of animal species is that this relates to the nature of the *political* objects to be explained, namely political constitutions. These last, Pellegrin says, are comparable 'only to a whole living organism and not to a "part"'.¹¹ But Pellegrin further discusses texts from the *Metaphysics*, notably first one from Z 16 which says that the parts of living things are potentialities (*dunameis*).¹²

(5) Pellegrin 1985, pp. 104ff, and 1987, p. 336.

(6) Cf. e.g. Lennox's review of Pellegrin 1982, and contrast Furth 1987 p. 52 n. 66 who applauds the suggestion that divisions focus on parts.

(7) Pellegrin 1987, pp. 336f.

(8) Quotations from Pellegrin 1987, pp. 336-8.

(9) Pellegrin 1985, p. 106.

(10) Pellegrin 1985, p. 106.

(11) Pellegrin 1985, pp. 101ff.

(12) Pellegrin 1985, p. 105 on *Metaphysics* 1040b5-8.

While he begins by noting that this 'might seem to hold directly against [the] moriological interpretation', he argues that correctly understood it does not. It does not assert (so he writes) that 'because the "parts" are "potentialities" they are not *ousiai*', but rather (merely) that the concrete individual is primary *ousia*¹³ because it is separable, which the parts obviously are not. Similarly in the paper in the Gotthelf-Lennox volume Pellegrin concedes that separability is a characteristic of *ousia* and yet Aristotle continues to qualify as *ousiai* certain items that do not meet the separability requirement.¹⁴ But then in the Balme Festschrift article a further passage, from *Metaphysics* Z 2, is adduced (1028b8) on which Pellegrin comments: 'Not only did some contemporary philosophers think it natural that the *moria* should be *ousiai*, but Aristotle, in *defending this thesis* (my italics), joined that part of the Presocratic tradition which held that the true reality of things is in their components'.¹⁵

There are complexities, subtleties and I fear I must confess for me also some obscurities in Pellegrin's position on this nexus of issues: but as I understand the notion, at least, the implications of the moriological interpretation for Aristotelian metaphysics are enormously wide-ranging. But is the interpretation well-grounded? First I have a number of perhaps minor queries on the question of definition, before I come to a fundamental objection on the score of substance.

First on questions to do with definition: Pellegrin notes that in Aristotle, as in Plato, division is a definitional method and he acknowledges that the dichotomists whom Aristotle spent so much time refuting had as *their* aim the definition of species.¹⁶ It might be thought surprising, then, that Aristotle does not explicitly take issue with them for *mistaking the proper objects of definition* (if, that is, Pellegrin is right, that *they* are the *moria*). Yet in all the extensive criticisms Aristotle offers of the method of the dichotomists, of the *differentiae* they appealed to, and of the results they got, there is no text that does just that. On the contrary he seems to suppose that their *definienda* are the *definienda* that he too should be concerned with, even though the way they set about getting definitions is radically mistaken.

Pellegrin has some supplementary arguments on the point and stresses as the chief objection to the idea that Aristotle was attempting definitions of animal species that 'he never gives us even a single

(13) Pellegrin 1985, p. 105: the expression 'primary *ousia*' in connection with the concrete individual in *Metaphysics* Z in unguarded: at least at p. 114 n. 7 Pellegrin shows that he recognises that 'first *ousia*' does not have the same meaning in the *Categories* as in *Metaphysics* Z.

(14) Pellegrin 1987, p. 337.

(15) Pellegrin 1985, p. 107.

(16) Pellegrin 1987, p. 323 and 1985, p. 104.

example' of such a definition.¹⁷ Yet that does not of course rule out the possibility that that was one of his *aims*, and indeed one of his chief quarrels with the dichotomists was, as he puts it at *PA* 644a10f, that they are unable to grasp any of the particular *animals* (*zōōn* cf. also *PA* 642b32, 643a16ff, b10ff). I shall come back to the problem of the gap between *aims* and *results* in the zoology in general terms later.

Secondly Pellegrin distinguishes between the concern to give a definition of such an item as *man* and the concern to define 'the human way of having feet' (the more correct way, he argues, to specify Aristotle's aim).¹⁸ But then the definiendum, on this account, is clearly not foot (in general), nor even human foot (because one of the characteristics invoked is that humans are *two-footed*), but rather — to rephrase Pellegrin's point — the mode of locomotion of humans. But that is one of the faculties of the human soul, and even on the orthodox view of definition would certainly be one item in the eventual full definition of *human*. Indeed that concern (with the mode of locomotion of humans) might be thought to belong more appropriately to a programme of defining *humans*, than to one aimed at definitions of parts such as *feet*. At this point some of Pellegrin's talk of the definitions of parts seems rather to obscure a distinction between a definition of a part (such as foot) *per genus et differentiam* where the genus is e.g. foot itself and the differentia the kind of foot, and a definition of a part set in the context of definition of the whole organism of which it is the part. On the latter reading it could be argued that the human way of having feet is essentially to be related to what it is to be a human, not to what it is to have feet.

But that cluster of puzzles is of minor importance compared with the difficulties in the interpretation offered of substance. The main problem here concerns not the zoology but the *Metaphysics*, specifically the relationship between the varying parts of Aristotle's discussion in *Metaphysics* Z. Z 2 is a summary of the usual views, as *dokei* at 1028b8 (and cf. 16) shows. That chapter cannot be taken to set out Aristotle's *own* views (despite Pellegrin) for two reasons: first having mentioned the view that the parts of animals and plants are substances (among other views) Aristotle immediately proceeds to insist that the question of whether they *are* indeed substances must be investigated, *skepleon*, 1028b15 (cf. also 31). Z 2 sets out an *agenda* and does not *defend* any thesis.

(17) Pellegrin 1985, p. 99: contrast the claims made by Gotthelf in Gotthelf 1985, pp. 27ff, and by Lennox in Lennox 1987a pp. 90ff, that at least partial definitions of animal kinds are common enough.

(18) Pellegrin 1985, p. 102, on further thoughts on *PA* 644a11.

Secondly the sequence of argument in Z as a whole tells against Pellegrin's interpretation. Z 16 clearly picks up the suggestion of Z 2 (the *dokousōn* of 1040b5 even echoes the *dokei* of 1028b8) and gives Aristotle's own views on the matter, and when he pronounces that most of what are thought to be substances are potentialities (including specifically the parts of animals, 1040b6) that does not allow that they may still be substances (as Pellegrin wishes to suppose) but must be taken as an argument *against* that view. By dealing with Z 16 first, and then Z 2, Pellegrin gives the impression that Z 2 can be taken as offering Aristotle's own views. But that is surely mistaken. In Z 16 the parts of animals fail to be substances on three grounds, all made explicit in the text. First there is the separability requirement mentioned at 1040b6ff: though Pellegrin protests that separability is not an overriding criterion,¹⁹ that does not mitigate the point that in *Metaphysics* Z at least it is invoked as fundamental (cf. e.g. Z 3, 1029a27ff). Secondly the parts of animals fail the test of unity. The passage Pellegrin quotes from 1040b5-8²⁰ continues as follows: 'for none of them [viz the parts of animals and the physical elements, earth, fire, air] is a unity, but they are like a heap, before they are concocted and some one thing comes to be from them.' Then Aristotle immediately goes on to say that while one might suppose that the parts of living creatures (and 'what is close to soul') are both, as being both in actuality and in potentiality, yet nevertheless they are still all potentially, when they are one and continuous *phusei*. When we are told that they are potentialities, this is indeed to tell against their being substances.

Thirdly and surely conclusively the end of Z 16 provides yet a further argument for the same conclusion. No substance, we are told (1041a3ff, picking up Z 13, 1039a3ff) consists of substances. Evidently the individual animals themselves, Socrates or that dog or this horse, are paradigmatic substances, maybe even, if we add in the argument from Z 17, 1041b28ff, the only substances. But if *they* are substances, then

(19) Cf. above at n. 14.

(20) Pellegrin 1985, p. 105. The whole passage, 1040b5-16 runs:

- 5 Φανερόν δὲ ὅτι καὶ τῶν δοκουσῶν εἶναι οὐσιῶν αἱ πλεῖ- 16
 σται δυνάμεις εἰσὶ, τὰ τε μέρη τῶν ζώων (οὐδὲν γὰρ κε-
 χωρισμένον αὐτῶν ἐστίν· ὅταν δὲ χωρισθῇ, καὶ τότε ὄντα
 ὡς ὅλη πάντα) καὶ γῆ καὶ πῦρ καὶ ἄλλ'· οὐδὲν γὰρ αὐτῶν
 ἐν ἐστίν, ἀλλ' οἷον σωρός, πρὶν ἢ πεφθῇ καὶ γένηται τι
 10 ἐξ αὐτῶν ἐν. μάλιστα δ' ἐν τις τὰ τῶν ἐμψύχων ὑπο-
 λάβοι μέρη καὶ τὰ τῆς ψυχῆς πάρεγγυς ἄμφω γίγνε-
 σθαι, ὄντα καὶ ἐντελεχεῖα καὶ δυνάμει, τῷ ἀρχᾷ ἔχειν
 κινήσεως ἀπὸ τινος ἐν ταῖς καμπαῖς· διὸ ἐνια ζῶα διαι-
 ρούμενα ζῇ. ἀλλ' ὁμῶς δυνάμει πάντ' ἐσται, ὅταν ᾖ ἐν καὶ
 15 συνεχὲς φύσει, ἀλλὰ μὴ βίᾳ ἢ συμφύσει· τὸ γὰρ
 τοιοῦτον πῆρωσις.

on the argument that no substance consists of substances, their parts are not.

Nor would it be easy, I think, to rescue Pellegrin's position on the primary objects of definition at least as an interpretation of *Metaphysics Z*. The argument of *Z 4*, as is well known, is that the primary objects of definition are substances,²¹ and if those arguments are added to those of *Z 2* and *Z 16*, the upshot would clearly be that the primary definienda are the animals, not their parts. When in *chh. 10-12* Aristotle warns against doing away with the matter, and specifies that — given that the animal is something perceptible — it is not possible to define it without movement and so not without the parts being in a certain state (1036b28ff),²² that emphatically does *not* say that the *parts* are the objects of definition. The definienda he (still) has in mind are, e.g. man and animal, as the examples make clear,²³ even while he insists that their definitions must incorporate reference to their parts. Which parts are parts of the *sunolon* and which of the *form* or *essence* are tricky questions which lead Aristotle into a complex discussion of several varieties of part/whole relationships.²⁴ But that discussion (and the whole of *Z*) presupposes that both the definiendum and the definition must, in a strong sense, be unities. The locus of Aristotle's interest in *Metaphysics Z* where both definition and substance are concerned remains throughout the *animal* considered as the unity it is, not such parts as the finger of 1034b29f, the hand of 1036b31, the flesh and bones of e.g. 1035a33, or even the heart of 1035b26.

That set of clear lessons from *Metaphysics Z* does not, of course, rule out the possibility that Pellegrin's views on the cardinal level of the *moria* are correct as an interpretation of the *zoology*. Yet the contrast between metaphysics and zoology would then be very striking indeed: as I said, the implications of the moriology for the metaphysics are very wide-ranging. But just how that contrast could be accounted for is highly problematic. The differences between a whole-orientated *Metaphysics* and the moriological orientation Pellegrin finds in the zoology are no mere minor shifts in emphasis, and it would seem that the only way to reconcile the two would be via some developmental hypothesis.²⁵ Yet neither of the two main possibilities is at all an attractive

candidate. Thus it could be argued that *Metaphysics Z* implies a rejection on Aristotle's part of the part-oriented zoological studies whose results are set out in the zoological treatises. Alternatively — and no less drastically — the zoology might be seen as implying a rejection of the lessons of *Metaphysics Z* on the question of the status of animal parts, on the doctrine of substance and on the primary objects of definition. The revisions in either case would, as I say, be *drastic*. Thus, on the first option, if the *Metaphysics* represents Aristotle's (new) realisation that the parts of animals do not count as substances and are not strictly definable, at least not the primary objects of definition, then the whole effort of the zoology (as Pellegrin presents it) is founded on a misapprehension. Alternatively (on the second option) if the zoology represents a (new) discovery on Aristotle's part that the determinant factors in zoology are the parts, then the discussion of substance oriented to wholes in the *Metaphysics* stands in need of serious revision to take that into account.

I do not say that such developmental hypotheses could not be suggested. But that some fairly massive effort at reconciliation would be needed between metaphysics and zoology, if Pellegrin's view of the latter is to be accepted, is, in my opinion, clear. It is not enough, in any event, merely to postulate a change of heart on Aristotle's part — although that was the way in which some developmental arguments used to be promulgated. What we have to see is *why* Aristotle should have held each of the conflicting views successively: we need to understand the motivations of the change, if indeed he did change his views. The moriological interpretation of the zoology in its strong form has, then, that high, perhaps unacceptably high, price to pay. It would seem preferable, rather, to retrench: to reconsider the factors that led to its proposal, to accept, rather, at most a weaker version of the thesis, according to which the interest in the parts in the zoology is *not* to be seen as cardinal nor as representing Aristotle's *ultimate* strategic concern, nor as superseding the ultimate focus of interest in *wholes*. On the modified view, the interest in parts would be a means to an end, not the end itself: though even on this modified view there are still, of course, interesting repercussions from Pellegrin's researches on the question, since they might well be taken to indicate the difficulty Aristotle faced in practice, in the zoology, in carrying through the programme of definition, that is to say the programme of the investigation of form that was so clearly one of his primary philosophical motivations. I do not know how far, if at all, Pierre Pellegrin himself would agree with that suggestion. But I shall adduce further arguments at the end which might be used to support a similar conclusion from reflection on Aristotle's practice in other areas of his zoology.

(21) E.g. *Metaphysics* 1030a11ff. At 1030a17ff, however, Aristotle says that definition and essence belong secondarily also to the other non-substantial categories.

(22) I come back to this below.

(23) E.g. *Metaphysics* 1036b3ff, 10ff, 28ff.

(24) Especially in *Metaphysics Z* 10 and 11.

(25) Pellegrin considers the possibility of a developmental hypothesis in connection with the *Politics* IV text, though he concludes by rejecting any such solution: 'faced by the difficulties of these chronological speculations, I would prefer to say that there is in Aristotle a coexistence without interpenetration of two methods of definition which differ at least in terms of their object' (Pellegrin 1985, p. 104).

I turn now to a second, perhaps even more influential and far-reaching suggestion that has been proposed on the basis of a reading of the zoology, namely the set of arguments that Balme has advanced in connection with his denial that Aristotle's biology was essentialist. The particular features of his line of interpretation that I wish to consider are the following: first of all there is the distinction between (a) species taken as a generalisation over individuals, (b) essence (which picks out those features for which a teleological account can be given) and (c) the (individual) animal form (which on Balme's view included such material accidents as sex and colour).²⁶ Secondly, following his conception of (c), Balme argues that matter can be, indeed must be, included in the definitions of animals. As he puts it²⁷ 'a definition of Socrates includes a complete account of all his matter at a given moment.' That implies not merely that matter should be included in definitions, according to Balme, but also the possibility of definition of an individual (Socrates), indeed of an individual in process. Balme argues that *Metaphysics* H 6 has it that 'at the moment of actualization matter and form are one thing,' and he proceeds:²⁸ 'considered as if frozen at a moment, a man is not two items, body and soul or matter and form, but one: a complex but graspable form. On the other hand, considered as he is in nature (which H 6 assumes to be the right way to consider him), a man is a process, not a static subject-predicate state. The analysis of a man, therefore — or of a snub nose — should be either a causal account of the process or a complete description of every detail as at a given moment. Either will include matter and movement.'

Let me begin with the first distinction, between species, essence and animal form, and certainly one may agree that there are sufficient explicit texts in Aristotle to legitimate the distinction between the species taken universally and its individual members. One of the clearest passages is Z 10, 1035b27ff: 'man and horse and the things said thus in relation to individuals, but universally, are not substances, but a *sunolon* made up of this *logos* and this matter as universal.' Certainly, too, one may go some way towards agreeing with the connection Balme suggests between essence and teleological explanation. Clearly in the case of animal kinds (which is what Balme is speaking about in the first instance) a teleological explanation of what it is to be that animal will be possible, and required. However the extension of the notion of *to ti ēn einai* to non-substance categories in *Metaphysics* Z ch. 4 may cause one to hesitate before going all the way with Balme here. As I have already remarked, that chapter says that one can talk of essences in a secondary

or derived sense, *hepomenōs* (1030a22) of qualities, quantities and so on. Given that the applicability of essence in this secondary sense to the non-substance categories seems quite unrestricted, the coincidence of essence and teleological explanation appears highly problematic. White is one of Aristotle's examples in that chapter. Even if we may concede that where all the members of a species have eyes of a particular colour, that may be part of that animal's essence and capable of final causal explanation,²⁹ it is coloured-eyes in this kind of animal that have a final cause, not this or that colour as such. Whether colours as such regularly have teleological explanations seems doubtful, and the same is no doubt true of many other non-substance items, which nevertheless will have secondary or derivative essences.

But it is of course in relation to item (c), animal form, taken to include 'all the material details and accidents'³⁰, that Balme has put forward some of his most striking, surprising and radical suggestions. One motivation for his view comes from reflection on the account of reproduction in *GA*, and the argument (without I hope too much distortion) goes like this.³¹ In *GA* Aristotle clearly states that the male parent contributes form alone. But in *GA* IV 3 especially we have a fairly detailed account of how the offspring comes to resemble the father (and how too the mother, or the grand-parents, or indeed no one at all, in which case the offspring is just an animal, not a human being or whatever). But if the offspring comes to resemble the father in being male (say) or in skin or hair or eye colour, then these characteristics must belong to the father's form. Thus Balme concludes:³² 'the definition of essence can never be the complete formal description, for it must always exclude such material accidents as sex and colour which *are* included in the form contributed by the sire.'

Now one way note, to begin with, a puzzling feature of this argument, which is that it starts from the firm distinction between form and matter and the insistence that the father's contribution to the offspring is form *and not* matter. But by the time we get to the conclusion it appears that the complete formal description is taken actually to *include* material accidents, such as sex and colour. (On the female side of the equation Balme explicitly notes that she does not contribute *just* matter, but also some formal characteristics: indeed all differences are for Balme formal differences³³ and so any contribution from the female parent that helps to differentiate the offspring will be

(26) See especially Balme 1987d pp. 295ff.

(27) Balme 1987d, p. 295.

(28) Balme 1987d, p. 310.

(29) This is to develop the concession implied by the *plēn* clause at *GA* 778a33.

(30) Balme 1987d, p. 309.

(31) Balme 1987d, p. 294-5.

(32) Balme 1987d, p. 294-5.

(33) This is explicitly stated at Balme 1987d, p. 294.

set on the formal side of the form/matter dichotomy.) On the view that all differences are formal differences, the characteristics that the offspring owes to the male parent belong, indeed, to form: but then should not be deemed to be matter — and so the idea that the form includes matter (even in the shape of 'material accidents') falls to the ground. But of course it may be that the weak point in the argument as thus set out lies not in the conclusion, so much as in that assumption that all differences are formal ones.³⁴ While one can see that in a sense to differentiate is to pick out some determinate character, and given that matter is in itself indeterminate, differentiation must be through form, there is another sense in which it is perfectly possible and indeed desirable to speak of differences in the *matter* of two individuals of the same kind. Aristotle still needs to distinguish the way in which a bronze triangle differs from a wooden one *from* the way in which a bronze triangle differs from a bronze statue.

But whether or not Balme would feel inclined to save his argument by modifying the modes of applicability of the principle that all differences are formal differences, the chief problem remains the interpretation of Aristotle's position, in *GA* IV 3, on the resemblances of offspring to their male and female parents. Though the analysis offered in that chapter is clear on some points, it is desperately indeterminate on others. To begin with some of the former: evidently the levels at which the male parent acts in its generative function are clearly distinguished. Coriscus is not just an animal, and a man, but is said to act as such and such a male, and indeed that means as Coriscus, the individual he is.³⁵ Aristotle's account of how it is that certain offspring resemble or do not resemble each of their parents proceeds by appealing to those differences in level together with a further distinction between the process he calls *existasthai* (which results in an opposite) and what he calls *luesthai* (where change is to what 'stands near', e.g. to a characteristic of a grandparent or of a more remote ancestor).³⁶ This enables Aristotle to account for the cases (a1) of a male offspring that takes after the father, (a2) of a female offspring that takes after the mother, (b1) a male taking after the mother, (b2) a female taking after the father, (c1) a male that takes after a grandfather or more remote ancestor, (c2) a female that takes after the maternal grandmother, and so on, not to mention cases where some parts of the offspring resemble one parent, while others do the other.³⁷

(34) Cf. Hamlyn's comments in 1985, pp. 56ff.

(35) E.g. *GA* 767b24ff, 768a1f.

(36) *GA* 768a14ff, b15ff.

(37) *GA* 768a21-b15.

Moreover qua generator Coriscus acts first and foremost as Coriscus (as the individual father) more, that is, as the particular man he is than as man, and more as man than as animal.³⁸ Aristotle leaves us in no doubt of the priority of *to idion* and *to kalh'hekastlon* to *to katholou*, and though, as is well known, what counts as *to kalh'hekastlon* depends always on the context, the repeated references to the named individuals Socrates and Coriscus show that it is indeed individuals, not species, that Aristotle here privileges.

But if so much is reasonably clear, elsewhere *GA* IV 3 leaves many questions unanswered. This applies particularly to the all-important issue of the nature of the resemblances between offspring and parent that the account is supposed to cover. So far as the generator goes, certain accidental features are explicitly discounted: we are not talking about Socrates as literate (*grammatikos*) or as someone's next door neighbour.³⁹ But while resemblance in being male or female is clear enough, otherwise the talk of offspring 'being like' father, mother or grand-parent is left quite unspecific. Given this indeterminacy, the way ahead in interpretation must be acknowledged to be risky. But if we use what Aristotle says elsewhere in *GA* I on the topics (1) of the resemblances between offspring and parents and (2) of the account to be given of certain characteristics by which individuals of the same species are distinguished (as opposed to characteristics that belong to the species as a whole), some conjectures seem possible. It is in *GA* I 17 and 18, of course, that Aristotle has a good deal to say about the first topic (and the danger in using that as evidence in relation to *GA* IV 3 is obvious: *GA* I 17 and 18 are a polemical examination and refutation of pangenesis, a doctrine that used resemblances between offspring and parents among other arguments to suggest that the seed must be drawn from the whole of the body). Two sets of remarks that Aristotle makes in this avowedly polemical discussion are, however, particularly relevant to how we interpret his own position. Having set out the pangenesisists' *lekmēria* in *GA* I 17 (including (1) the alleged fact that mutilated parents produce mutilated offspring, and (2) the general resemblance between children and parents not just in inherent, *sumphuta*, i.e. congenital characteristics, but also in acquired ones, *epiktēta*, such as scars⁴⁰), Aristotle's opening gambit in I 18 is to object that children resemble their parents in certain respects where (even his opponents will have to agree) *nothing* is drawn from the part in question: he specifies *voice, nails, hair, movements*.⁴¹ There are too some characteristics that the parent

(38) *GA* 767b25ff, 30ff, 768a1ff, 5ff, 24ff, b13ff.

(39) *GA* 767b28f.

(40) *GA* 721b11ff, 14ff, 20ff, 29ff.

(41) *GA* 722a5ff.

does not yet possess when the child is generated, such as grey hair or a beard. Again the children resemble their remote ancestors 'from whom nothing comes' (viz. *they* do not make a direct contribution to the seed of the parents themselves). More strikingly still, at 722a18ff he argues (still within this polemical context of course) that the resemblances hold rather (*mallon*) in respect of the anhomoiomerous parts (such as face, hands and legs), rather, that is, than in the homoiomerous ones (flesh, bone, sinew) — a remark that does not rule out resemblances in the latter as well.

That gives us at least a preliminary check-list of the items that Aristotle's own account should, in theory or in principle, be able to accommodate. Recognising that there are resemblances between parents and offspring in respect of hair (for instance) — that is not in respect of their having hair, but in respect of their having hair of a particular sort (curly or straight, or of a certain colour) — and again in voice — again not in respect of having voice, but in respect of having a voice of particular sort (deep, high-pitched, big or small for instance) — and again in respect of hands and legs, and even flesh and bone — Aristotle *ought* to be able to give *some* account of these 'facts', obviously not a pangenesis account that would have it that the explanation lies in the principle that the seed is drawn from the whole of the body, but an alternative to that account and presumably superior to it.

But of course an account of a number of the items in our check-list is actually offered by Aristotle in *GA* V, not so much in the context of a discussion of parent-offspring resemblances, but rather in his general account of what he calls the *palhēmala* he there identifies, where he leads off with the examples of eye-colour, of voice-pitch and differences in colour, hair and feathers.⁽⁴²⁾ *GA* V distinguishes clearly between characteristics that regularly belong to all (normal) members of a kind and those that vary between individuals of the same kind: and evidently it is the latter that are his concern when he discusses resemblances of offspring to parents — for he is not there interested, obviously, in what all offspring have in common with all the parents in the species in question, as it might be having a heart, having legs, having eyes — but rather in the resemblances in having legs or eyes of some particular sort. But *GA* V specifically discusses the type of account that can be given of the *palhēmala* it mentions. We are told that they are not for the sake of something, but they come to be 'by necessity' — and although the interpretation of the necessity involved here and elsewhere is certainly controversial, notably the cash-value of the distinction

(42) *GA* 778a17ff. Eye-colour is discussed in *GA* V 1, voice in *GA* V 7, differences in colour, hair and feathers in *GA* V 3, 4 and 6.

drawn between two types of necessity at 778b16ff (of having an eye, and of having a particular sort of eye) — that should not deter us unduly, since the statement at 778a35 makes it plain enough that the necessity there opposed to 'that for the sake of which' is such that the causes of the items in question should be referred back, as he says, 'to the matter and the moving cause.'

It is worth recalling that at the outset⁽⁴³⁾ *GA* announces that it is particularly concerned with the moving cause. The first chapter of *GA* I divides the four causes there identified into two pairs, where that for the sake of which (the end) and the *logos lēs ousias* (which are said almost to amount to one and the same, 715a5f) are together opposed to (3) matter and (4) the *archē kinēseōs*. As we should expect, then, it is the interplay of (3) and (4) that provides the basis of his account of reproduction, with (3) being identified as the contribution of the female (for the male supplies no matter) and (4) being the chief male contribution. But while there is no wavering on Aristotle's part on the principle that the male parent supplies nothing material to the offspring, just how it acts as *archē kinēseōs* is less transparent than one might suppose. It is tempting to assume that the efficient cause always just is the form in action, in its dynamic function, that is it always just transfers or imposes form. But we should be careful: the relationships between the form of the object produced (itself a *sunolon* of form and matter) and the form of that which produced it (where again we may be dealing with an element in a *sunolon*, a composite object, though sometimes it is just the form that acts) can be varied and complex. First we may note those texts in *GA* I 1, II 1 and V 1 where the efficient cause is linked with the material cause and this pair is contrasted with the final cause and the *logos lēs ousias*.⁽⁴⁴⁾ But Balme might accommodate these texts by insisting that what that last expression, *logos lēs ousias*, picks out is the essence, not the animal form.

However secondly and more importantly, if we consider the range of modalities of efficient causes in Aristotle a number of possibilities suggest themselves. In some cases a proximate moving cause acts by transmitting its own form (shape) directly to the matter: a signet ring leaves its impression in wax.⁽⁴⁵⁾ But in other accounts of the action of moving causes the situation is more complicated. Take some of the analogies Aristotle in fact repeatedly uses to illustrate features of sexual

(43) *GA* 715a3ff.

(44) *GA* I 1, 715a3ff, is cited in the previous note. *GA* V 1, 778a35, is cited in my text, above p. 20. In *GA* II 1, 731b 21ff, proximate mover and matter are together opposed to that for the sake of which.

(45) Cf. *GA* 729b17f, where, however, Aristotle's purpose is to illustrate general features of the form-matter doctrine, and the point at issue in the theory of reproduction is limited to the doctrine that the male supplies no matter.

reproduction, such as those that appeal to the action of human craftsmen,⁴⁶ the carpenter making the bed, the builder the house, and the series of comparisons with cooking, concocting and curdling. In the former, what makes the bed (in the sense of the proximate moving cause) is the carpenter's tools, and (unlike the signet ring case) they do not themselves *have* the shape of the bed. Of course the tools are moved by the carpenter and he has the form of a bed in mind (as Aristotle often puts it, it is the house without matter, viz. in the builder's mind, that creates the house with matter).⁴⁷ But *that* form is to equated with the essence. At least I recall no passage where Aristotle specifies that the craftsman's thoughts about what he is making include the material accidents that Balme says are included in form.

The cooking, concocting, curdling analogies differ from building and carpentry — and differ from one another, notably that in the curdling case the fig-juice, we are told,⁴⁸ forms no part of the end-product, whereas in cooking the effect is the result not of a body, but of heating. Yet in these cases too the proximate efficient causes do not themselves *have* the form eventually exemplified in the end-product. The heat that cooks the eggs, sugar etc. into a soufflé is not itself a soufflé, nor even soufflé-like. That image is particularly appropriate since it provides a particularly clear illustration of the way in which the varieties of the end-product depend on the *proportion* or *balance* of the heat applied to the materials to be cooked — a point that Aristotle repeatedly stresses in relation to the illustrand, the need for *summeltria* between the male efficient cause and the material supplied by the female.⁴⁹

Now none of these other cases of efficient causes *exactly* fits the case of sexual reproduction: none of the analogies is perfect. Nevertheless we may ask how far they can take us towards resolving the issue of the role of the male parent. From one point of view, given that the male parent produces or can produce a look-alike, his blue eyes being reproduced in the blue eyes of his offspring, it might seem that the signet ring model might be invoked. But it clearly will not do, given that the father acts via the semen (described as the tools used)⁵⁰ and — unlike the signet ring case — the *semen* does not of course look like Socrates: it is not blue-eyed, it does not even have eyes; it is not snub-nosed, for it has no

(46) See e.g. *GA* 723b29ff, 729b16f, 730b5ff, 11ff, 734b36ff.

(47) See e.g. *Metaphysics* Z 1032b12: at 1032b1f (cf. 1035b32) Aristotle makes clear that by *eidos* here he means essence.

(48) See *GA* 737a13ff.

(49) See especially *GA* 767a13ff, 768b25ff, 772a17ff; cf. also 723a29ff, 727b11ff, 729a16ff, 739b3 (of the womb), 743a28f, 777b27ff.

(50) E.g. *GA* 730b19ff, cf. 766a3ff.

nose. It does its work thanks to the *movements* that it initiates: and throughout the account of resemblances in *GA* IV 3 Aristotle pays due attention to the fact that the outcome is the result of an *interaction* between what initiates the movement and the matter involved. When the matter is totally worked up, the result is a male resembling the father (evidently the semen initiates movements that in the normal or ideal case lead to the new *sunolon* being as like the old as possible — as is stated at *GA* 766b15 and 767b15). But deviations of various kinds are possible and to be expected, when either the semen is weaker, or the material stronger, than is ideally desirable.⁵¹

Balme's argument was that the father supplies only form and so *that* must include all the items, such as sex and colour, which are or may be reproduced in the offspring. But an alternative account of resemblances in such items as colour, at least, seems possible and maybe preferable. Where such factors as eye-colour, hair-colour, pitch of voice and so on are concerned, the clear lesson of *GA* V is that these all depend on an *interaction* of two factors, the moving cause and the matter (in some instances in *GA* V Aristotle invokes other material conditions such as diet and climate, for example in the explanation of straight and curly hair).⁵² And if it is by *interaction* that we should explain eye-colour, the same will also apply, presumably, to *similarity* in eye-colour between parent and offspring. Even when the offspring has blue eyes like the father, those blue eyes depend (as the father's did) on a particular outcome of the interaction of matter and moving cause. The moving cause cannot operate on its own, evidently, even though when it does act on the matter, it may act as far as possible to reproduce its own pattern of movement, and for it to fail to do so is, precisely, a failing, either in its capacity to move or in that of the matter to be moved. The capacity of the semen is better described, that is, as a capacity to produce movement than (just) as a matter of possessing a form that it transmits. It is responsible for transmitting essence, the *logos tēs ousias*, where a teleological account is possible: there is no dispute there. But where having an eye of a particular colour is concerned (as

(51) The possibility of failures of perfect match is also allowed for by Aristotle's talk of potentiality and actuality. The embryo as it develops proceeds through a series of stages of the successive actualisation of higher and higher potentialities, and given that this continues to be the case for some time *after* the semen has initiated the first movement, this allows Aristotle to identify a series of (increasingly significant) potentialities, each of which may fail to be actualised, in the stages of development through which an embryo passes. If the first stage depends *directly* on the action of the semen, later stages do so only indirectly.

(52) Climate is mentioned as a factor at *GA* 782b34f (curly hair), cf. 783a15f, and 788a17f (pitch of voice). The food eaten is a factor in colour at 786a34ff. Cf. also 767a28ff, 30ff.

opposed to having an eye) that outcome, according to *GA V*, seems to depend crucially on the complication in the equation introduced by the interaction of movement and matter. Accidents, that way, are to be explained by that interaction, not included in the account to be given of form, or rather not explained, we should say, by whatever is to be included under the heading of form.

The issue is and is likely to remain controversial (cf the different account recently offered by Cooper 1988 and cf. Code 1987). The talk of resemblances of offspring to parents in *GA IV 3* is quite general and as I said indeterminate. There are problems in using *GA I 17* and *18* as evidence of cases of resemblances Aristotle should be able to accommodate, but if we do and appeal to *GA V* for its account of some of them, the upshot is a different possible story, in those cases, to the one that led Balme to include material accidents in animal form. So far as references to the priority of Coriscus acting as Coriscus goes, those need not lead to any clear division between animal form on the one hand, species and essence on the other. Aristotle would clearly have many reasons to deny that what generates is a *disembodied* form and many reasons to deny that it is a disembodied essence that does so or again some universal (the species as such). Whatever we say on the complex and controversial questions of individual form,⁵³ Aristotle never ceased to believe that the concrete *sunolon*, Socrates or Coriscus, is substance, as many texts in *Metaphysics Z* and *H* testify⁵⁴ even when those texts occur in the context of discussions where the term 'first' substance is reserved for form or essence.⁵⁵ Certainly in generation it is the individual that does the work: but if I am right to stress the role of talk of moving causes in Aristotle's account, then the individuality in question, what makes it the individual moving cause it is, could as well be a matter of it being the individual *sunolon* it is as one of its being an individuated form — one individuated in any of the ways that have been suggested by Frede and others in part to meet the well known difficulties of the refutation of universal as substance in *Metaphysics Z 13*. Otherwise put, that talk of Coriscus acting as Coriscus in *GA IV 3* seems indecisive on that other problem of the individuation of form.

However if those issues remain open to argument, on further points the consequences Balme drew from his analysis pose problems that seem insurmountable. I refer to some of his remarks on the subject of *definition*, some of which I have already quoted. Citing passages in *Metaphysics Z* Balme argued⁵⁶ that the species Man as a universal

(53) See most recently Frede 1985 and Frede and Patzig 1988.

(54) E.g. *Metaphysics Z* 1033b16ff, 1035a1, 1039b20ff, *H* 1042a26ff.

(55) As for example at *Metaphysics* 1032b2, 1037a28.

(56) *Metaphysics* 1033b25, 1035b28, 1037a6 and *Z 13* are cited by Balme at 1987d, p. 295 n. 24.

generalized over individual men-in-flesh is not the substance whose definition is sought. 'The only two contenders for valid definition', Balme proceeds, 'are Socrates' essence (soul) and Socrates in the flesh.' A string of further passages in *Metaphysics Z* are listed in the footnote, but he goes on that while the *Metaphysics Z* discussion leaves the issue open (between those two alternatives, that is), *Metaphysics H* resolves it. There 'at the moment of actualization matter is identical with the form realized in it, so that the composite is a definable unity.' 'It follows that a definition of Socrates includes a complete account of all his matter at a given moment.' The account to be favoured is one of man as a process, and so includes both matter and movement.⁵⁷

Now some of the problems in all of this are referred to by Balme himself a little later in appendix 2. 'This solution raises the question whether Aristotle now envisaged definition only at the level of the individual particular: to be valid, must the definition of 'man' be a definition of Socrates at a moment?'⁵⁸ If so, Balme goes on, 'it is a change of view from the *Topics*, where the definiendum is always a class, not a particular', and he further notes that the view would need accommodating with the view that Socrates and Callias are 'the same thing in form' in *Metaphysics Z*. But the problems are far worse than those remarks acknowledge, and they do not just concern squaring the 'solution' with the *Topics* and the end of *Z 8*. Let me outline briefly the four most serious difficulties, which stem as much from problems in the reading of the *Metaphysics* as they do from those of the zoology.

(1) That talk of the primacy of considering man as a process runs directly counter to the repeated insistence, both in the *Metaphysics* and in the zoology, that Aristotle is concerned with the *ousia* rather than with *genesis*, and with the latter only for the sake of the former. *PA* 640a18 is one of a whole series of texts that make the point unequivocally, and *GA* 778b6 is another that does so in the heart of *GA V 1*. It might be thought that Balme could easily accommodate this objection by rephrasing his point in terms of actualisation, not process; yet that would involve a quite different reading of the sense in which *movement* can be included in the definition: I shall come back to that.

(2) In the particular text in *H 6* on which so much is made to rest, which Balme takes to show that 'at the moment of actualisation matter is identical with the form realized in it', what Aristotle actually says is rather more guarded: it is that the proximate matter and the form are

(57) Balme 1987d, p. 295, where n. 25 cites *Metaphysics Z* 1039b20-31; cf 1035a33,

b14-31, 1036a1-9, 1037a24-33.

(58) See Appendix 2 to Balme 1987d, pp. 306ff, at p. 311.

one and the same, the one in potentiality, the other in actuality.⁵⁹ That that continuation is important and provides the right reading becomes clear three lines later, when he puts it that what is in potentiality and what is in actuality are one in a way (*pōs*). It is only with what has no matter, that they are *unqualifiedly* one.⁶⁰ This permits no erosion of the distinction between potentiality and actuality, no erosion of that between proximate matter and form. Even if we are considering the axe doing some cutting (viz. actualising its potentiality for cutting) there is no question of our not being able to distinguish (in thought) between the matter of the axe, of the mere potentiality for cutting, and the form, or its actuality. So far from providing a unique solution to the problem of the unity of form and matter, H 6 says no more (and no less) than many other passages that discuss form and matter, or (in the case of living creature) soul and body, as the two aspects into which the given *sunolon* can be analysed.⁶¹

(3) Thirdly and more damagingly, there is the question of definitions of individuals. The difficulties that Balme mentions are much less serious than others that might be thought to arise from some of the texts he refers to. Not just in the *Topics* but in the *Metaphysics* itself, indeed in the chapters of Z Balme cites, Aristotle insists that definition is of the universal, *and* that no definition of the individual is possible. As texts that make the first point one may cite 1035b34 in Z 10, 1036a28f in Z 11: as texts that make the second 1036a2ff in Z 10, and 1039b27ff in Z 15, which says: 'For this reason, of the perceptible individual substances there is neither definition nor demonstration'. And why? 'Because they have matter whose nature is such as to be able both to be and not to be.' And later in the same chapter (1040a5ff) he remarks that it is always possible to refute anyone who tries to define a particular:⁶² for it is not possible to define them. As for the texts in *Metaphysics* Z that Balme referred to in support of the claim that the only two contenders for valid definition are Socrates' essence and Socrates in the flesh, those passages⁶³ do absolutely nothing to legitimate the assumption that an

(59) Whether *to men* is to be read at H6, 1045b19, is disputed, but Ross's note gives cases where *ho men* or *to men* suffer ellipse before *ho de*, *to de*, in Aristotle, even though Ross goes on to add that the ellipse would be unusually harsh here.

(60) *Metaphysics* 1045b23.

(61) See especially *Metaphysics* Z 11, 1037a7ff, Z 15, 1039b20ff.

(62) Some of those who attempted to define particulars were Platonists who had in mind Platonic Forms: so Aristotle believes he has arguments not only against defining his own individual *sunola* but also against defining Platonic Forms conceived as belonging to the class Aristotle labels as *la kath' hekasta* (*Metaphysics* 1040a8ff).

(63) The first text Balme cites, 1039b20-31, includes at b28ff a clear statement to the effect that there is no definition and no demonstration of perceptible individuals. The second, 1035a33, is immediately preceded by a text that states that the matter is no part of the form (*eidos*) (1035a19ff). The third, 1035b14-31, ends with a clear statement that

individual (however described) is a possible object of definition: all they do is make the well known distinction (which can always be made in the case of any perceptible *sunolon*) between the *sunolon* as the *sunolon* it is (viz. a composite of matter and form) and the form that gives the *sunolon* its distinctive character (or essence). (The denial of the universal's claims to be substance, expressed already in Z 10, 1035b27ff, before it is argued for in detail in Z 13, is a denial that e.g. horse taken universally is substance, viz. this form and this matter so taken — universally. But whatever we make of that doctrine, neither there nor anywhere else in Z, nor anywhere else in the Aristotelian Corpus I should say, is there any statement defending the definability of individuals as such, or reneging on the clear doctrine ruling out such definitions in Z 10, 11 and 15.)⁶⁴

(4) Finally the attempt to allow matter into definition runs foul of similar objections. Z 11 states categorically that of the *sunolon* consisting of matter and form there is no *logos*,⁶⁵ where *logos* presumably has a strong sense, definition, since that some *logos* in the weaker sense of account is possible is clear from Z 7, 1033a4f, for instance. Z 11 gives the argument: 'it' (the *sunolon*) 'is with matter: for that is indeterminate, *aoriston gar*.'⁶⁶ (Whereas the *logos* is according to the primary substance, e.g. of soul in the case of man.) The passage carries all the more weight since it comes in a recapitulation of the lessons to be learnt from Z 10 and 11 together. 1037a25ff picks up the argument in 1036a2ff which specifies that of the *sunolon* particular (this circle, whether perceptible or intelligible) there is no *horismos*: but they are always said and recognised by virtue of the universal *logos*: while matter is unknowable in itself.⁶⁷ The concessions to the argument that not

Socrates already contains matter, and the fourth, 1036a1-9, similarly refers to the perceptible or intelligible matter of individuals and states explicitly (1036a5f) that there is no definition in such cases. The last, 1037a24-33, explains both the sense in which there is, and that in which there is not, a *logos* of the *sunolon*, specifying that there is *not* of it taken to include the matter, since matter is indeterminate. The very fact that the grounds that Aristotle consistently invokes to rule out definition of individuals is that the individual contains matter (perceptible or intelligible) will be grounds for rejecting any view that the animal form, construed as Balme construes it to include all the material accidents, can be a possible subject of definition.

(64) The problem that is posed by the conjunction of the two doctrines, (1) that definition is primarily of substance, and (2) the universal is not substance, does not get resolved by Aristotle by abandoning the view that definition is not of individuals, which seems firmly in place still in *Metaphysics* Z 15. How those several views are to be reconciled is, however, of course, one of the most controversial topics in the interpretation of *Metaphysics* Z.

(65) *Metaphysics* 1037a25ff.

(66) *Metaphysics* 1037a27ff.

(67) *Metaphysics* 1036a7ff.

everything should be reduced to number, and that matter should not be done away with (1036b21ff) evidently do *not*, in Aristotle's view in the recapitulation at the end of that chapter, legitimate any view that matter can now straightforwardly be included in definition. True we are told that a living creature cannot be defined 'without *kinēsis*' and so not 'without the parts being in a particular state'⁶⁸: but overinterpretation of this must be avoided. If we bear in mind the way in which the faculties of soul are defined in the *De Anima*, it seems likely that we are invited to specify such items as reproduction and nutrition, perception, locomotion (*kinēsis*), imagination and reason. No doubt in specifying the locomotive faculty we shall need to refer to the animal being biped, quadruped, footless or whatever. But while this encourages us to specify the modalities of locomotion, it is doubtful how far it represents any departure from Aristotle's customary view, that definition is of the *soul*, though we no doubt have to bear in mind that with the exception of *nous* all the faculties of soul are first actualities of parts of the body. Yet clearly including 'biped' in the definition of man is still a long way from countenancing the inclusion of — as Balme puts it — 'all his matter at a given moment.' That thesis, with its startling suggestion that we apparently need to include in our account of 'Socrates in the flesh' all his warts and bunions not to mention the contents of his stomach, goes well beyond anything for which support can be found in *Z* — or indeed in the zoological works. No doubt both in *Z* and in the zoology, especially *PA* I 2-4, the model of definition Aristotle works with is appreciably more complex than the simple combination of genus plus ultimate differentia that many of the standard Academic examples presuppose. No doubt in practice he realised that a fair range of differentiae will have to be included in any zoological definition. Yet the guiding principle is still, surely, differentiae of the soul, of the vital activities that is, and there is no need and no justification for extending the definition to include all the matter.

Thus far I have examined some cases where if the results of recent studies are accepted, the implications for Aristotle's metaphysics would be momentous: and the gist of my argument has been that the case for ascribing the drastic changes in view-point imagined is not proven. It is not, however, that — against the trend of some of my own earlier essays — I now wish to advocate or defend some kind of diehard unitarian thesis where Aristotle's zoology and metaphysics are concerned. Rather it has always been the case and always will be that we have to have good reason for attributing major (or even minor) shifts in theory to Aristotle, and where such seem inescapable we should

(68) *Metaphysics* *Z* 11, 1036b28ff, cf. 'not without the *ergon*', 'not without perception' at *Z* 10, 1035b16ff.

further attempt to specify the grounds that suggested the need for change. So far as differences in perspective between the zoology and the metaphysics go, it seems necessary to be more cautious than some recent speculations. Yet even within the range of topics I have discussed, some differences in emphasis, if not shifts in doctrine, seem detectable. Certainly in his account of the generation of animals the *pairing* of efficient and material causes and the contrast between them as a pair and the final cause and *logos tēs ousias* represent not, it is true, any *revision* of the doctrine of the four causes (for all four continue to be identified and distinguished) but at least a particular emphasis that can perhaps be contrasted with the canonical line-up where matter is often opposed to the other three.⁶⁹ There is no need whatsoever to see Aristotle as having changed his mind (in one direction from physics to zoology, or in the other from zoology to physics): but we have here, perhaps one example (and no doubt others might be suggested) where the practice of a particular inquiry involves Aristotle in putting a *distinctive* emphasis on certain particularities.⁷⁰

On the question of the proper objects of definition, on causation, on substance, the implications of the zoology are not, in my view, as far-reaching as some recent claims have it. But in one other respect I believe they may be far-reaching enough. Let me introduce very briefly one further topic, following up points that I have argued for recently elsewhere.⁷¹ The *Organon* sets out certain rather stringent requirements on predication, for the sake of demonstration and for syllogistic reasoning generally, notably on the univocity of terms. For demonstrations in particular, as is well known, the primary premisses must in addition be true, immediate, better known than, prior to and explanatory of the conclusions. Clearly if the univocity requirement, at least, is not met, valid inference will not be possible. But when it comes actually to doing some physics, especially though not exclusively zoology, that requirement is under considerable strain. Aristotle devotes some extended discussion in *PA*⁷² to the ways in which such fundamental terms as hot, cold, dry and wet are said in many ways. Yet while he there distinguishes, for example, between accidental and essential heat, between potential and actual, and gives various signs by which heat can be judged, for instance by various effects, this hardly amounts to a definitive *resolution of the difficulties*: no more does

(69) As at *Ph.* 198a24ff for instance.

(70) Thus the requirements of the analysis of the subject-matter of the *Meleorologica* have consequential effects on the causal schemata actually deployed in that treatise.

(71) Lloyd 1987, ch. 4.

(72) See especially *PA* 648a21-649b8, 649b9ff.

the account offered in the *De Generatione et Corruptione*.⁷³ Yet given both the role of these opposites as the primary qualitative differentiae in his element theory, and more especially the recurrent appeal to vital heat in particular throughout his physiological doctrines, one might think it to be absolutely crucial that Aristotle has absolutely clear criteria to appeal to, and moreover criteria that are independent of the differentiae he uses these opposites to explain.

A similar and related case is presented by such a term as *pepsis* 'concoction'. Here we have an attempt to distinguish different types of *pepsis* in *Mele.* 4, where he identifies ripening, boiling and roasting/baking and claims that there are natural counterparts to the last two artificial processes, though these have not been given distinct names.⁷⁴ Yet while some problems in the range of application of the terms are recognised, including some cases where metaphor is involved,⁷⁵ Aristotle still allows himself extraordinary freedom, using *pepsis* not just of the processes of digestion, but of the production of semen and its action on the menses, the development of the embryo, the hatching of eggs, the formation of blood, fat, suet, milk and residues such as urine.⁷⁶ Are we dealing with the *same* process in each case? Why does concoction of nourishment lead in one case to semen, in another to fat, in yet another to marrow?⁷⁷ Again if digestion is like ripening and like cooking, the problem arises of why we cannot just eat unripe and uncooked food and let the stomach do *all* the necessary concoction. There had better be some justification available to Aristotle for the application of the same term to such widely disparate phenomena: we had better be able to say we are dealing with clearly defined species of the same general process, or with processes that can be said to be the same 'by analogy'. The instances are indeed all linked in that they are effects of heat, but heating is not *just* what *pepsis* is, not even if we specified 'vital heat': we still need to differentiate it from other cases of heating and indeed to differentiate *its* various types — other than merely by their effects: for *so* to differentiate them will not be explanatory but merely circular.

(73) *GC* II 2, 329b7ff, with a characterisation of the four primary opposites in terms of their ability to combine other things and of their capacity to be delimited by their own boundary. On the difficulties of seeing those characterisations as providing the clear definitions needed for the deployment of hot, cold, wet, and dry in the zoology see Lloyd 1987, ch. 4.

(74) *Mele.* 379b10ff, 380a11ff.

(75) *Mele.* 380b13ff, 28ff, in relation to the 'boiling' of gold or of wood.

(76) For some representative texts, see *PA* 652a9f, *GA* 719a32ff, b2, 727a34ff, 744b1ff, 753a18ff, 756b28f, 775a17ff, 776a20ff, b33ff, 780b6ff, *Mele* 380a1ff.

(77) See, for example, *GA* 727a34ff, cf. *PA* 651a20ff, b20ff, 28ff.

The *APo.* gives as an illustration of an explanation the syllogism that accounts for deciduousness in terms of the coagulation of fluid — Aristotle eventually specifies sap⁷⁸ — and presumably coagulation, fluid, sap had all better be terms that meet the univocity requirement. I do not say that there is any evidence of Aristotle ever modifying that model: but certainly the zoology provides plenty of evidence of the problems encountered in his *practice* of natural science.⁷⁹ It is not just that actual explanations set out in syllogistic form are difficult to find: the whole discourse of the practising natural scientist resists, one might say, being recast in the mould of the ideal formal language that the *Organon* desiderates.⁸⁰ Problems will arise not just with terms like fluid or wet, *hugron*, but also for example with coagulation, where Aristotle thinks this can result from heat as well as from cold.⁸¹ But though the *APo.* evidently hopes that the results of research can eventually be expressed in the ideal terms of demonstrative syllogisms, the actual practice of Aristotle's zoology is the richer and maybe the more fruitful for being some way away from that ideal.

So I return finally and in conclusion to the question of the applicability of the *APo.* to the zoology — to its applicability, not to its actual application, since so far as such issues as the actual presentation of explanations in syllogistic form goes there is general agreement on *their* rarity (though there may remain disagreements on how easy it would be to recast the explanations actually given in standard form). There are well known passages in the zoology in which Aristotle speaks of *apodeixis* as the aim of the biology.⁸² Certainly no one would expect him *not* to be interested in explanations of the *dioli*. Yet for the

(78) *APo.* 98a35ff, b5ff, 33ff, 99a23ff: contrast 'fluid' at 98b37, with *opos* at 99a27. The addition of '*ē ti allo loioulon*' at 99a27 suggests that the account in terms of coagulation of sap is meant merely as an illustration of the *type* of explanation that might be invoked.

(79) See further Lloyd 1987, ch. 4.

(80) Following Kosman, Gotthelf 1987a, p. 195 distinguishes between the *APo.* as a demand for a formal account of proper science, and *APo.* as a demand that proper science be formal. But even on the first view, as Gotthelf concedes, proper science should be formalisable, and even if we limit ourselves to *that* demand, there is still a gap between that claim and the practice of, e.g. *PA*. There is not only no apparent attempt to formalise the results: but no signs of concern with their formalisability, a concern, for instance, with the need eventually to secure the appropriate indemonstrables, or even a concern to limit the discussion to terms that can meet the strict univocity requirement. The failure of many key terms to meet that requirement represents an insuperable obstacle to the *APo.* style formalisation of the results — the proposed explanations — in which they figure, and the tolerance of such terms suggests a lack of any preoccupation with such an endeavour.

(81) See *PA* 649a30ff, *Mele.* 388b10ff. Among the effects of *pēxis* we find mentioned curdling of milk (*GA* 729a11ff): cf also *Mele.* 382b30ff.

(82) E.g. *HA* 491a13f, cf. the more controversial *PA* 640a6ff and *GA* 742b23ff, 28f.

APo. model to be applicable *in detail*, not only must there be the possibility of recasting the conclusions in syllogistic form, but these demonstrations *should* proceed from indemonstrable primary premisses. Now Gotthelf has recently considered the question of the first principles in play in the *PA* especially and has concluded that Aristotle's discussion follows a 'broadly axiomatic' structure.⁸³ But so 'broad' — I should say — as to be almost unrecognisable. The *APo.* sets out clear distinctions, of course, between three kinds of primary indemonstrables, (1) axioms, (2) 'hypotheses' (3) definitions. But how far can these be imagined as applicable to zoology? The two general principles, the law of non-contradiction, and that of excluded middle, must be counted to be fundamental to all intelligible discourse, to be sure. But nothing *follows* from them in zoology, at least. There are, however, other axioms limited to specific fields, such as the mathematical axiom that if equals are taken from equals, equals remain. There are two questions here: *are* there such axioms in zoology? And indeed could there be? One of Gotthelf's suggestions about the 'quasi-axiomatic' principles at work in the zoology is that they include the principle that nature does nothing in vain. That is, it may be agreed, some kind of regulative principle that has to be assumed for fruitful work to be done in the inquiry into animals. But so far from being able to assume it as an *axiom*, Aristotle spends a good deal of time and energy justifying and recommending it against those who, he knew, denied it. The situation is, then, quite different from the tactics he uses in giving an elenctic demonstration of the principle of non-contradiction in *Metaphysics* Γ. Nor can the principle that nature does nothing in vain be compared with the equality axiom — for which, indeed, no parallel seems to be suggestible from the zoology. There would seem to be no possible axioms of that type in natural science — nor, again, does Aristotle appear to use, or even contemplate using, hypotheses in the sense defined in *APo.*

The only likely candidate for indemonstrable starting-points in the zoology is, then definitions. But we come back to the point that *in fact* Aristotle often shows some signs of hesitation in offering definitional accounts, and often acknowledges that the terms that are in play in his own discussion are 'said in many ways'. It is ironic, to my mind, that Gotthelf opts for hot, cold, wet and dry as examples of *APo.* style first principles,⁸⁴ at least if I am right that the *GC* account just will not do as a resolution to the difficulties identified in *PA* II 2 and 3.

(83) Gotthelf 1987a, see for example p. 179, cf p. 194. I intend to devote a separate study to this question.

(84) Gotthelf 1987a, pp. 185ff.

APo. style indemonstrables are not, we surely have to conclude, in evidence in the zoology. But that is not to say that Aristotle may not have continued to hope that the results of his work in that area might be got into good *APo.* style demonstrative order. Demonstrations, at least *apodeixeis*, are — in *some* sense — the aim. But if we just had Aristotle's actual practice in zoology to go by, we would surely attribute to him a notion of demonstration, in this area, that is a good deal less formal and rigid than that we find in *APo.* Although in *APo.* he clearly expected his schema to be applicable in the study of both animals and plants, when it actually comes to the study of the former, at least, the questions of just how far he remained wedded to that schema, of just how far he realised the difficulties in its implementation, are open ones. From the practice of the zoology it cannot be shown that he consciously revised the schema. Yet given that in certain respects at least Aristotle shows no great inclination to cast his results in the form the schema dictates, we have two possible lines of interpretation. On the one hand there will be those who will prefer to believe that the *APo.* remains the unaltered *ideal*: that has been one of the motivations of recent work on the zoology, and it has brought to light some positive features of Aristotle's discussion that had hitherto been neglected (as I noted in connection with Lennox on the concern for the widest class to which a property belongs). On the other hand there will be those who may suspect that in some respects, at least, the actual investigation of animals may have led Aristotle to reconsider some aspects of that *APo.* schema.

It that alternative view can certainly not be *proved*, it may still be *recommended* with lines of argument that draw on two sets of considerations. First there is the evident price that Aristotle would have had to pay, had he set out to secure, in zoology, indemonstrables of the types he demands in *APo.* and that can most readily be exemplified from mathematics. Was it really relevant to seek the equivalent of the equality axiom? Might not Aristotle have realised that the differences between mathematics and physics extended further than his use of biological and botanical illustrations in *APo.* appeared to allow? Secondly I am struck by one feature of that modern scholarly endeavour to explore the possible translation of the zoological investigations into canonical *APo.* form, namely the artificiality that that introduces into the discussion. Of course the syllogisms claimed to be recuperable from the materials in the zoology are not claimed, by those scholars who do the recuperating, to be great science:⁸⁵ no more are the

(85) See, for example, the syllogism proposed by Gotthelf 1987a, p. 178 n. 33 with the conclusion that viviparousness without polydactylity and no-non-horn means of defence belongs to all horn-possessors, and cf. Bolton's discussion of definition (Bolton 1987, especially pp. 152ff, 163ff).

proposed definitions, per genus et differentiam, taken to be candidates for the title of zoological indemonstrables. Yet the suspicion remains that Aristotle, once fully launched on the enterprise of the investigation of animals, — an enterprise undeniably stimulated by high-level metaphysical notions of form, finality, substance, actuality and the like — may not have even aimed at recasting the results of that investigation, eventually, to conform to all of the ideals of the model of syllogistic demonstration set out in *APo*.

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TAXINOMIE, MORIOLOGIE, DIVISION

Réponses à G. E. R. Lloyd

Pierre PELLEGRIN

Au point où en sont parvenues les études sur la biologie aristotélicienne, une critique comme celle de Geoffrey Lloyd est salutaire. Emportés par l'ivresse de leurs succès, les interprètes n'ont-ils pas eu tendance à considérer prématurément certaines difficultés comme résolues? Soucieux que nous étions d'intégrer la recherche biologique d'Aristote dans l'ensemble de sa philosophie, n'avons-nous pas fini par passer un peu vite sur des différences théoriques sinon insurmontables du moins très importantes, et ceci en réaction contre ceux de nos prédécesseurs qui avaient creusé un fossé infranchissable entre les textes logico-métaphysiques et les textes biologiques d'Aristote? Ce que Lloyd nous invite à faire (nous, c'est-à-dire les interprètes qui travaillons plus précisément sur le corpus biologique aristotélicien), c'est à renoncer à certaines lectures que nous avions proposées des textes zoologiques parce que ces lectures semblent à Lloyd incompatibles avec les doctrines professées ailleurs par Aristote, notamment dans la *Métaphysique*. Sans vouloir rechercher le consensus à tout prix, ce qui serait d'ailleurs un vice plus pardonnable que d'autres, il me semble donc qu'au-delà des critiques, parfois rudes, que Lloyd porte contre nous, il y a un accord fondamental, plus fort que nos divergences. Il vaudrait d'ailleurs mieux dire « communion » qu'« accord », puisque ce qui nous réunit c'est la *foi* en l'unité conceptuelle et méthodologique de l'aristotélisme, cette foi qu'il nous appartient maintenant de transformer en *savoir*. Il faut donc répondre à Lloyd, en espérant que ses critiques nous aideront à sortir de l'« interprétative anarchy » qui selon lui régne aujourd'hui entre nous, encore qu'il faille sans doute préférer cette vivante anarchie à la mortelle uniformité d'une vulgate orthodoxe.

Je ne répondrai pour ma part qu'aux critiques que Lloyd m'a personnellement adressées, laissant à David Balme le soin de répondre sur le reste.

SUR LA CLASSIFICATION

Lloyd a, me semble-t-il, sur ce point l'impression de mener un combat d'arrière-garde : il s'avoue « recidivist ». Je voudrais simplement montrer ici, sans reprendre l'examen des textes, que par-delà notre large accord, il demeure une vraie divergence entre Lloyd et moi parce que notre « querelle » sur la taxinomie est l'effet d'un désaccord historico-épistémologique. Tout le monde est aujourd'hui d'accord sur les points suivants : (I) Aristote fait un emploi relatif des termes *génos*, *eidos*, *analogia*. (II) Il n'y a pas de taxinomie (paléo)-linnéenne chez Aristote. On pourrait donc, dès lors, se demander si tout, ou du moins l'essentiel, n'est pas dit sur le problème de la classification des animaux. Il faut y regarder de plus près, ou, plutôt, y regarder « plus profond ».

Pour expliquer qu'on ne trouve pas trace de taxinomie animale, même à l'état d'ébauche, dans le corpus aristotélicien, il n'y a que trois hypothèses possibles : (i) Aristote s'était donné les moyens de construire une taxinomie animale mais nous avons perdu les textes dans lesquels il réalisait cette possibilité ; (ii) Aristote s'est heurté au problème de la taxinomie, on peut donc considérer qu'il a eu un projet taxinomique, si embryonnaire soit-il resté, mais il n'a pas commencé de réaliser ce projet : c'est la thèse de Lloyd ; (iii) la taxinomie n'a pas été pour Aristote un problème théorique : c'est ma thèse.

En reconnaissant chez Aristote un « interest in eventually supplying a comprehensive classification of animals », Lloyd ne fait que reprendre sous une forme plus prudente la thèse qu'il avait soutenue à ce propos dans son ouvrage *Science, Folklore and Ideology* paru en 1983¹, selon laquelle avec Aristote la taxinomie devenait un problème (cf. p. 205). Il faut ici bien voir qu'une telle thèse revient à faire d'Aristote l'initiateur de la taxinomie, car ce n'est pas tant la réalisation effective d'une taxinomie « correcte » (c'est-à-dire à la fois cohérente et suffisamment étendue) qui marque la naissance de l'entreprise taxinomique ; c'est, si l'on peut dire, le déblaiement d'un espace théorique destiné à être celui de l'entreprise taxinomique. Or ce que j'ai voulu montrer dans mon livre sur la *Classification des animaux chez Aristote* ce n'est pas seulement qu'il

(1) Je me permets, pour ne pas devoir reprendre ici ce que je pense de cet ouvrage excellent, de renvoyer au compte-rendu que j'en ai fait dans la *Revue philosophique*, 1984, n° 4, pp. 447-451.

n'y avait pas de taxinomie effective chez Aristote, car, assurément, on ne m'avait pas attendu pour s'en apercevoir, mais qu'il n'y avait pas de place pour un projet taxinomique dans l'entreprise aristotélicienne. Ainsi c'est parce qu'il a en vue une biologie définitoire, étiologique (notamment, mais pas seulement, finaliste) et « apodictique » qu'Aristote ne se donne même pas la peine de recueillir des renseignements sur *tous* les animaux auxquels il avait accès. D'autre part, et cet argument me paraît particulièrement fort, quand Aristote traite le problème de la diversité animale pour lui-même, il le fait, comme j'ai tenté de le montrer bien des fois², par le biais d'une reconstruction des différents vivants par combinaison de leurs parties, et non par des procédures (paléo)-taxinomiques, c'est-à-dire à la manière de Mendéléiev plutôt qu'à celle de Linné.

Mais il me faut aller encore plus loin : j'accorde bien volontiers à Lloyd qu'il serait possible de construire une (paléo)-taxinomie à partir des *lexles aristotéliciens*. C'est d'ailleurs ce qui a été tenté plusieurs fois dans l'histoire au moins depuis Wotton et Césalpin, et ces tentatives, même si elles n'ont pas été aussi dignes d'attention que celles d'Adanson et de Linné, doivent être placées, au même titre que ces dernières, dans l'histoire de la taxinomie. C'est donc au prix d'une féconde mais réelle trahison du projet aristotélicien que les naturalistes taxinomistes se sont assigné Aristote comme ancêtre. L'idée que les textes sont porteurs de développements non seulement étrangers mais contraires aux intentions de leurs auteurs n'est plus faite pour étonner qui que ce soit, et Lloyd moins que personne, tant il est vrai que peu de gens ont marqué aussi bien que lui la spécificité des questions que se posaient les Anciens. On retrouve d'ailleurs dans l'histoire maints exemples d'une telle situation. Les physiciens du temps de Galilée ont les moyens théoriques de concevoir le principe d'inertie, mais, dans la logique de leur recherche, ce n'est pas pour eux un problème théorique. Même Galilée ne semble pas l'avoir formulé qui en fait pourtant effectivement usage. De même pour l'hypothèse de l'évolution chez Buffon et même chez Cuvier, cas particulièrement étrange pour le continuisme spontané qui est le nôtre tant les faits, fort bien connus d'observateurs aussi minutieux, semblent « parler d'eux-mêmes » contre l'immutabilité des espèces.

La thèse (iii) peut prendre deux formes : (a) Aristote a formulé, mentalement ou oralement, le problème de la construction d'une taxinomie, puis l'a disqualifié comme pseudo-problème (il me semble vraisemblable que tel été le cas de l'hypothèse évolutionniste ou au moins transformiste dans le cas de Cuvier) ; (b) il ne l'a pas formulé mentalement parce que ce problème lui était étranger (tel me semble être

(2) Cf. par exemple mon article « Les fonctions explicatives de l'histoire des animaux d'Aristote », *Phronésis* 1986/2, pp. 148-166, et l'article cité dans la note suivante.

le cas de l'inertie). La solution (a) ajouterait encore un fantôme théorique à ceux dont les commentateurs ont peuplé l'œuvre d'Aristote, et doit, par prudence, être abandonnée en l'absence de tout témoignage textuel.

Bref, l'hypothèse selon laquelle avec Aristote la taxinomie devient un problème, et, par voie de conséquence, une *tâche théorique*, mais que cette tâche n'a pas reçu le moindre commencement de réalisation me paraît aller à la fois contre le bon sens historique et les textes d'Aristote.

SUR LA MORIOLOGIE

C'est principalement sur ce point que se concentrent les critiques que m'adresse Lloyd, et leur portée est considérable puisque ce qui est en jeu c'est, encore une fois, l'unité conceptuelle de l'aristotélisme. Contrairement aux apparences mes divergences d'avec Lloyd sont finalement beaucoup moins profondes sur la moriologie que sur la taxinomie.

Je ne suis pas devenu moriologiste par plaisir ou par goût du paradoxe, et Aristote non plus sans doute. Et je crois que Lloyd a raison de poser le problème en termes de *coût théorique*, et c'est ce que j'ai l'impression d'avoir toujours fait. Ma thèse générale est la suivante : Aristote a été conduit à la moriologie par la logique même de son projet de biologie spéculative. Or les avantages biologiques de la moriologie, s'ils ne sont pas gratuits, sont d'un coût métaphysique suffisamment faible pour être acceptable.

Ne pouvant faire totalement l'économie de quelques considérations générales, j'adopterai pour cela le mode d'exposition de type popperien, assurément un peu simpliste mais pédagogique, que j'ai utilisé ailleurs³.

En concevant une science des vivants, Aristote fait un choix principal, qui est celui du finalisme. Cela dans le contexte particulier de l'affrontement de théories rivales, que je réduirai, comme dans l'article cité ci-dessus, à ce qu'on peut appeler l'atomisme mécaniste et le finalisme, qui existaient notamment l'un sous sa forme démocritéenne l'autre sous sa forme platonicienne. Aristote est un platonicien du fait que/ce qui fait qu'il choisit le finalisme contre ce que nous appelons le mécanisme. Or l'atomisme mécaniste était suffisamment fort au temps d'Aristote pour avoir mis le finalisme en difficulté sur le problème de la diversité des vivants dont l'atomisme mécaniste rend pour sa part facilement compte par sa procédure combinatoire de construction des

(3) Cf. « De l'explication causale dans la biologie d'Aristote », *Revue de Métaphysique et de Morale*, 1990, n° 2, pp. 197-219.

différents organismes. Face à ce défi, le zoologiste téléologiste qu'Aristote entend rester n'a guère le choix qu'entre trois solutions : (i) régresser à un providentialisme qu'il a critiqué ailleurs (« il pleut non pour augmenter les récoltes mais par nécessité », *Physique* II, 8, 198b18) : peut-être Aristote a-t-il été tenté par cette solution quand il écrit dans la *Politique* que « les végétaux sont faits pour les animaux et les animaux pour l'homme » (I, 8, 1256b16), encore qu'il ne s'agisse pas là même d'une ébauche de traitement du problème de la *diversité* des vivants. Une zoologie et une anatomo-physiologie apologétiques comme celles du *Timée* sont alors possibles, mais pas une zoologie « réelle » comme celle qu'ambitionne Aristote ; (ii) expliquer la diversité métaphysiquement, par exemple par la dégradation de l'unité comme le feront les différentes doctrines émanatistes : cette solution est étrangère à la métaphysique aristotélicienne et serait, Lloyd me l'accordera, d'un coût très élevé ; (iii) subordonner la combinatoire à la téléologie, puisque l'inverse est impossible à Aristote s'il entend rester fondamentalement finaliste.

J'ai essayé de montrer⁴ que la réduction moriologique du monde vivant permettait de choisir cette seconde voie. Aristote peut ainsi sauver le finalisme, ce qui est pour lui l'essentiel, en le mettant hors d'atteinte de la critique de l'atomisme mécaniste sur le problème crucial de la diversité. Ceci n'est qu'un *exemple* des avantages *biologiques* de la moriologie. On pourrait en signaler d'autres, par exemple celui-ci, qui concerne le finalisme lui-même. D'une part, en effet, l'explication téléologique des animaux entiers suppose l'explication téléologique de leurs parties, et d'autre part s'il y a chez Aristote une « intention » de la nature, elle se manifeste plus clairement au niveau des parties. Car les parties ont des fonctions, ce que les animaux entiers n'ont pas à proprement parler : leur seule fonction c'est de vivre. Les animaux entiers manifestent donc une téléologie naturelle en quelque sorte passive par leur adaptation. Les parties, au contraire, manifestent une téléologie active par leurs fonctions.

Tout se passe comme si Aristote entendait *sauver métaphysiquement* ces avantages c'est-à-dire les rendre compatibles avec sa doctrine métaphysique. Ceci, tout comme l'histoire esquissée ci-dessus de la naissance de la biologie aristotélicienne dans le contexte de l'affrontement de théories rivales, n'est que simulation théorique et n'implique notamment de ma part aucune hypothèse chronologique : je ne prétends ni qu'Aristote a adapté sa biologie à sa métaphysique, ni l'inverse. Voyons donc l'un des aspects essentiels de ce « sauvetage métaphysique ».

Sur la question de la convergence entre métaphysique et biologie, qui est l'objet principal du papier entier de Lloyd, l'essentiel des

(4) Cf. « Les fonctions explicatives ».

critiques qu'il m'adresse porte sur le problème de l'*ousia*. Sur ce point je commencerai par une auto-critique. C'est Lloyd qui m'a rappelé (et j'ai dû aller vérifier pour m'en convaincre) que j'avais écrit, dans mon article «Aristotle : a Biology without Species», que «in Aristotelian biology the *ousiai*, in the primary and strong sense, are the *moria*». Je reconnais qu'il y a dans une telle phrase un désir de pousser jusqu'au bout une thèse que je continue à tenir pour vraie. Je me suis aussi rendu compte que la version française de cet article n'a pas cette phrase, qui est donc une touche polémique et, de ce fait, excessive. Mais la version française n'a jamais été publiée et ne peut en aucun cas servir d'excuse.

La position de Lloyd est nette : le livre Z de la *Métaphysique* interdit de considérer les parties des animaux comme des *ousiai*. Dès lors soit il y a chez Aristote un fossé conceptuel important, sur ce point fondamental qu'est la doctrine de l'*ousia*, entre biologie et métaphysique, soit la moriologie est une chimère, et c'est bien cette deuxième possibilité dont la critique de Lloyd entend montrer la réalité. Je remarquerai tout de suite, et avant même d'aborder le fond du débat, que la lecture la plus immédiate des textes nous orienterait sans doute vers la première possibilité tant la présence des «parties» est massive dans la biologie d'Aristote.

Stricte sensu la thèse de Lloyd est juste, comme je l'ai toujours reconnu. Les passages de la *Métaphysique* disant que les parties des vivants ne sont pas des *ousiai* sont bien connus, et les textes qui disent l'inverse doivent être replacés dans leur contexte, ainsi le texte d'ouverture de Z, 2 qui rapporte l'opinion «commune» laquelle en attribuant l'ousiété aux corps, l'attribue aux vivants, à leurs parties, aux éléments... (1028b8). Je ne pense absolument pas, contrairement à ce qu'affirme Lloyd, que ce texte de Z, 2 soit le dernier mot d'Aristote sur le problème des relations entre parties et *ousia*. Ma thèse générale ne peut être formulée sous la forme «les parties sont des *ousiai*», mais tout au plus sous la forme «les parties peuvent être considérées comme des *ousiai*», ou «sont en un certain sens des *ousiai*».

On pourrait décrire le mouvement même du livre Z (auquel on peut peut-être adjoindre le livre H) de la *Métaphysique* comme celui de la construction d'un modèle pur d'*ousia* en vue de la comparution de candidats à l'ousiété. Ce modèle propose des critères positifs et négatifs. Positifs : pour être *ousia* il faut être : τόδε τι, χωριστόν, ἀχὴ καὶ αἰτία τις⁵ (cette dernière exigence me paraissant fondamentale); il faut être à la fois «par soi» et intelligible à un degré tel qu'Aristote en arrive à soutenir que ce qui fait qu'un étant substantiel est *ousia* c'est sa forme. Négatifs : Lloyd insiste sur le critère selon lequel une *ousia* ne peut pas être composée d'*ousiai*.

(5) Cf. *Métaphysique* Z, 3, 1029a27; 17, 1041a9, etc.

Modèle très exigeant au crible duquel les parties des animaux ne passent certainement pas. Quant aux animaux entiers s'ils y passent c'est de justesse, car en tant que réalités composées de matière et de forme il n'est pas sûr qu'ils aient une essence, et s'ils en ont une ce ne peut être au sens le plus fort comme le rappelle justement Michael Frede dans ce même volume. Or il y a deux manières de s'écarter de ce modèle fort :

(i) une manière absolue : le blanc ne pourra en aucun cas être *ousia*, même si l'on peut considérer que, d'un certain point de vue, il peut avoir une essence et même une «quiddité»;

(ii) une manière relative, qui est celle qui nous intéresse ici. Une réalité qui n'est pas exclue du champ de l'ousiété peut être *plus ou moins ousia*. Ainsi la matière est *ousia* en un sens affaibli mais non métaphorique : ὅτι δ' ἐστὶν οὐσία καὶ ἡ ὕλη, δῆλον (*Métaph.* H, 1, 1042a32); et je suis de ceux qui pensent que le μᾶλλον du fameux passage de Z, 3, 1029a29 (διὸ τὸ εἶδος καὶ τὸ ἐξ ἀμφοῖν οὐσία δόξειεν ἂν εἶναι μᾶλλον τῆς ὕλης) doit s'entendre en un sens comparatif et non exclusif : «en conséquence la forme et le composé sembleraient être plus substance que la matière» et non «être substance bien plutôt que la matière» (Tricot). De même le composé peut être dit «σύνολος ... οὐσία» (1037a30). Mais si l'on a situé l'ousiété au niveau de ce que l'on peut exiger de la forme, alors le composé n'est pas *ousia*. Ma fréquentation parallèle des textes logiques et biologiques d'Aristote m'a amené à faire de cette variation en intensité des termes et des procès⁶ une indispensable règle de lecture du corpus aristotélicien. On pourrait sans doute montrer que ce système de variation va avec (je ne sais où est dans ce cas l'antécédent et où est le conséquent) la structure globalement *mimétique*, et non participative, de l'univers sub-lunaire aristotélicien : les *ousiai* «imparfaites» ne reçoivent pas tant quelque chose de l'*ousia* parfaite qu'elles ne *font (contrefont)* les *ousiai*.

Des multiples conséquences de cela j'en retiendrai deux :

(i) à part l'*ousia* éminemment *ousia* (qui est peut-être le dieu) il faut, en lisant Aristote, affecter l'ousiété de toute chose d'un coefficient. Si les parties sont *ousiai* elles le sont moins que les animaux entiers, si les parties anoméomères sont *ousiai* elles le sont plus que les parties homéomères, etc.;

(ii) ce changement de niveau peut rendre caduques certaines règles énoncées par Aristote à propos de la définition du modèle pur de l'*ousia*, et notamment de la règle, invoquée par Lloyd, selon laquelle une *ousia* n'est pas composée d'*ousiai*. Ou plutôt cette règle ne reste valable que si

(6) Des termes *génos* et *eidos* et du procès de division notamment, sur lesquels je reviens un peu plus bas.

l'on ajoute « de même niveau ». Le *synolon*, par exemple, qui est *ousia* de coefficient 2 est composé de forme (*ousia* de coefficient 1) et de manière (*ousia* de coefficient 3). Dans toute sa généralité la règle invoquée par Lloyd doit donc s'énoncer : si on considère une *ousia* de coefficient x , ses parties ne seront pas des *ousia* de coefficient x ; ou : quand le degré d'ousiété se trouve fixé au niveau x , les parties d'une *ousia* de niveau x ne seront pas des *ousiai*.

Si donc les parties des animaux ne s'écartent pas absolument du modèle pur de l'*ousia*, comme le fait par exemple le blanc, il n'est tout simplement pas aristotélicien de se demander *ἄλλως* si elles sont des *ousiai*. Or les parties, ou du moins certaines d'entre elles, ne sont pas extérieures à l'ousiété dont elles présentent certains caractères. On peut par exemple leur adjoindre des accidents : « La chaleur appartient à la notion du sang comme le blanc à l'homme blanc » (P.A. II, 3, 649b25).

Voici donc ma réponse à ce qui me paraît être l'un des arguments principaux de Lloyd contre ma lecture moriologique. Il me reproche de ne pas voir que le chapitre Z, 16 de la *Métaphysique* disqualifie les parties dans leur prétention à l'ousiété, et cela contre la doctrine commune rapportée en Z, 2 qui fait des parties des *ousiai* : « when he [Aristote] pronounces that most of what are thought to be substances are potentialities (including specifically parts of animals, 1040b6) that does not allow that they may STILL be substances (as Pellegrin wish to suppose) but must be taken as an argument *against* that view ». Il faut certainement accorder à Lloyd qu'au niveau d'ousiété dont il est question en Z, 16, les parties *ne sont plus ousiai*. Mais ceci n'abolit pas absolument l'ousiété des parties. D'où l'ambiguïté du « still » de Lloyd, que j'ai mis en capitales dans son texte : ne plus être *ousia* à un niveau donné d'ousiété ce n'est pas être à jamais expulsé du champ de l'*ousia*. Z, 16 *dépasse* Z, 2 mais ne l'abolit pas. C'est ce que montre, par exemple, la récapitulation particulièrement intéressante du chapitre H, 1 de la *Métaphysique*. Aristote y distingue quatre sortes d'*ousiai* : (i) celles sur lesquelles tout le monde est d'accord : les éléments, les corps simples, les plantes, les animaux et leurs parties; (ii) celles qui ne sont admises que par certaines écoles : Idées et Choses mathématiques; (iii) celles qui ont été établies au livre précédent (*ἐκ τῶν λόγων*, 1042a12) : la « quiddité » et le substrat, qui sont des termes proprement aristotéliens, dans sa forme pour le premier, dans son emploi pour le second⁷; (iv) le genre et l'universel. On peut ensuite repérer dans ce passage les deux manières, signalées plus haut, de s'écarter du modèle fort de

(7) On voit donc que quand il récapitule le livre Z qui a établi *in fine* l'ousiété éminente de la forme (et de la quiddité) Aristote ne renonce pas à conférer une certaine ousiété au substrat.

l'*ousia* : nous avons vu que « ni le genre ni l'universel ne sont des *ousiai* » (1042a21), ce qui laisse d'ailleurs mal augurer de l'ousiété des Idées et des Choses mathématiques car « c'est par le même raisonnement qu'on estime qu'elles [les Idées] sont des *ousiai* » (1042a16). Il s'agit là d'une exclusion absolue. Que les *ousiai* restantes s'écartent relativement du modèle pur, la formule citée plus haut « ὅτι δ' ἐστὶν οὐσία καὶ ἡ ὕλη, δῆλον » (1242a32), suffirait à le montrer. Le degré d'ousiété exigé à la fin du livre Z n'est donc considéré par Aristote ni comme seul possible, ni comme définitivement fixé.

Je suis prêt, cependant, à reconnaître la nécessité d'atténuer certaines de mes expressions. Il est maladroit de dire que les parties des animaux *sont des ousiai*, et Aristote ne le fait que rarement, bien que cela lui arrive comme nous venons de le voir. Mieux vaut dire qu'en biologie les parties des animaux ont deux rapports principaux à l'*ousia* : (i) elles peuvent être dites avoir une *ousia* ou une *quasi-ousia* (le sang a une « quiddité » P.A. II, 3, 649b22); (ii) elles peuvent appartenir à l'*ousia* d'un animal, c'est-à-dire, en bonne orthodoxie aristotélicienne, faire partie de sa forme⁸. Il n'en reste pas moins que les parties des animaux peuvent jouer un rôle central dans la biologie aristotélicienne sans que cette moriologie entre en conflit majeur avec la doctrine métaphysique de l'*ousia*. Les parties me semblent, en tout cas, participer suffisamment de l'ousiété pour remplir le rôle théorique fondamental qu'Aristote leur assigne. Un des aspects les plus importants de ce caractère ousiologique des *moria*, c'est qu'elles sont définissables, ce qui m'amène à répondre, pour finir, aux critiques que Lloyd adresse à mes propos sur la division définitoire.

SUR LA DÉFINITION

Dans ce domaine aussi, si Lloyd adoptait une lecture moins absolutiste des textes aristotéliens, beaucoup de problèmes qu'il soulève contre moi s'évanouiraient.

Je prétends que les parties des animaux ont une définition que la division permet d'atteindre, parce que c'est ce que disent les textes. Mais je n'ai jamais prétendu, sinon par erreur, inadvertance ou excès polémique que j'abjure aujourd'hui, que la division ne peut être appliquée qu'aux *seules* parties comme Lloyd me le fait dire. On peut

(8) Cf. tous les textes répertoriés et analysés par Allan Gotthelf dans sa contribution aux *Mélanges offerts à David Balme* : « Notes towards a Study of Substance and Essence in Aristotle's *Parts of Animals* ii-iv », in A. Gotthelf (ed.) *Aristotle On Nature and Living Things*, Pittsburgh Bristol, 1985, pp. 27-54.

parfaitement, avec les concepts aristotéliens, diviser les animaux en classes et définir l'homme ou le chien. Si de pareilles définitions ne sont jamais construites dans le corpus aristotélicien, qu'en déduire d'autre sinon qu'elles n'intéressent pas Aristote? De quel droit Lloyd déclare-t-il que la définition des espèces était l'un des buts («aims») d'Aristote? Que penser d'un but qui est à la portée de votre main et que vous n'entreprenez même pas d'atteindre, sinon que ce n'était pas un de vos buts? Je veux néanmoins réaffirmer un point qui me semble fondamental : le couple *génos-eidos* peut fort bien s'appliquer aux familles animales, mais il s'y applique de manière plus faible qu'il ne s'applique aux parties des animaux, c'est-à-dire en puisant moins largement dans son contenu logique. J'ai trop souvent traité ce point pour y revenir ici en détails⁹.

Ceci éclaire un point soulevé contre moi par Lloyd et que je veux évoquer ici parce que je l'avais supprimé, pour des raisons éditoriales, de la version anglaise de mon «Aristotle : A Zoology without Species». En critiquant les Platoniciens Aristote semble tenir pour acquis qu'ils cherchaient à définir les espèces animales (c'est ce que montrent notamment les exemples donnés par Aristote des dichotomies des Platoniciens dans les *Parties des animaux* : ils rangent les poulpes tantôt parmi les animaux aquatiques tantôt parmi les animaux terrestres, etc.), mais il ne les attaque pas sur ce point précis. Les Platoniciens sont incapables de mener la division à son terme parce qu'ils mélangent ce que j'ai appelé les «axes de division» (ils divisent par exemple les animaux à pieds en sauvages et apprivoisés, ce qui revient à diviser selon l'accident). Mais le fait de rechercher une définition des espèces ne semble pas être un péché aux yeux d'Aristote. Assurément, comme le fait remarquer Lloyd, définir «the human way of having feet» c'est bien se donner l'un des éléments de la définition de l'*humain*. Il est même tout à fait vraisemblable qu'à propos de la définition des espèces aussi Aristote pense qu'il pourrait surclasser les dichotomistes. Il n'en reste pas moins que dans le reste du corpus biologique ce sont des parties qu'Aristote entreprend de définir¹⁰.

Il m'est évidemment impossible de reprendre ici les raisons, à la fois biologiques et métaphysiques, pour lesquelles Aristote me semble avoir opté pour une approche moriologique du monde vivant. Pas plus que d'entreprendre de montrer une fois de plus que c'est à propos des parties que le schéma diérétique fonctionne le mieux dans le champ biologique. Ces points ne semblent d'ailleurs pas contestés par Lloyd.

Lloyd me propose un compromis qui vaut traité de paix : «to accept, rather, at most a weaker version of the thesis, according to which the interest in parts in the zoology is *not* to be seen as cardinal nor as representing Aristotle's *ultimate* strategic concerns, nor as superseding the ultimate focus of interest in *wholes*». Mais cette proposition me semble devoir être inversée pour être valable : le «focus of interest in wholes» n'est certainement pas «ultimate», mais premier. Car pour Aristote, et dans la perspective ousiologique qui est la sienne, les *ousiai* proprement dites du monde vivant ce sont les animaux entiers. Mais la biologie a ses exigences et Aristote est «unitarien», comme Lloyd, et comme moi, du moins est-ce pour nous l'article de foi dont je parlais au commencement de ces remarques. L'une des conditions de la construction de cette première biologie de l'histoire a consisté à dépasser l'immédiat foisonnement des formes vivantes pour découvrir le jeu de parties en nombre limité dont on peut étudier les variations. Ce qui suppose que l'objet d'études principal du biologiste ce sont les *moria*. Pour être compatible avec la direction générale ousiologique de la recherche aristotélicienne, cette étude moriologique doit conférer aux parties un statut de (quasi)-*ousiai*. Cela est particulièrement net en ce qui concerne la division définitoire qui s'applique plus pleinement aux parties qu'aux animaux entiers.

(9) Cf. mon article «Logical difference and biological difference» cité par Lloyd.

(10) Je me permets encore une fois de renvoyer à mon article «Les fonctions explicatives de l'Histoire des animaux d'Aristote».

MATTER IN THE DEFINITION

A reply to G. E. R. Lloyd

DAVID M. BALME

M. Pellegrin has kindly permitted me to reply to Geoffrey Lloyd's critique of my interpretation, since I was unable to attend the conference at Oléron.

The main issue is Aristotle's concept of matter. In speaking of it both Lloyd and I, in common with most people and with Aristotle himself, speak of matter as if it were a separable self-subsistent thing. But of course only proximate matter is separable, and then not qua matter but qua an informed object which can act as matter for something else. Matter qua matter is not a thing but a role played by things. The matter of X is stuff that can become X. It can be determined into X-form because it has the necessary qualities: flesh, blood and vessels can be determined into a heart or liver, and therefore they are the matter of heart or liver. But if we disintegrate X in thought, its constituents are not just pieces of matter but are themselves formal determinations of the matter-of-flesh or matter-of-blood, etc.; the matter of blood is nutrition, and again we may consider nutrition separately, in which case we are looking not at matter but at a formal determination of plant products which could be used as the matter of animal food but in themselves are combined wholes of form and matter. The bloodness of blood and the corn-ness of corn are their formal determinations. We can in thought strip away the form and consider the proximate matter, and then strip away *its* form and then the form of *its* matter, but we shall never arrive at a matter which exists by itself and possesses qualities: that would contradict the notion of matter, for matter is not something but is potential-something. Therefore when we speak shortly of PQR as the matter of X, what we

mean in full is that PQR are things which have the necessary forms to act as the matter of X. Since matter by definition has no form, when we speak of material differences we mean the formal differences between proximate matters. Aristotle safeguards this point at 1036a32 where he says that the circles which appear in bronze and stone and wood have been imposed upon things differing in form (*eidei*). It would have eased his argument if he could have said simply that these circles differ only in matter, but instead he has to argue that bronze is not part of the circle's being. Similarly at 1034a8 he does not say that Callias and Socrates differ in matter but *because of* matter. A material accident therefore (again a misleading shorthand phrase) is a formal feature which is due to the proximate matter's own form: it is not itself a bit of matter qua matter (*per impossibile*).

At *Melaph.* H. 6 Aristotle explains that within a combined whole, although we distinguish in thought between the stuff which is its matter and the form which the whole possesses, both matter and form refer to one and the same object: the matter is the whole lump of stuff which is capable of becoming the X, and the form is its present determination as an actual X. Lloyd is right to say that this is normal doctrine and that the distinction between form and matter is not eroded here: indeed I never meant to suggest that it was eroded, for that would destroy the solution to the *Mel. Z* puzzle. Surely the point is that in a combined whole all of the matter is determined by the whole's form: in the heart there is no part that is not flesh and blood, and there is no flesh and blood that is not heart — so long as it remains part of the living heart. It follows that if its form is defined, everything is defined: there is no undetermined matter, and no need to consider matter at all. At the next moment, in nature, the heart will have changed; it might die, and so become a mere heap of proximate matter on the way to recycling as matter for worms. But taken out of change, as at a moment, the combined whole is entirely determined in a form which can be grasped and defined. This form necessarily includes all the matter, and is therefore individual. This solution to the *aporia* therefore rests upon showing that matter can be included in the definition provided that it is considered not qua matter but qua determined, and that such is the case in nature.

Now taking Lloyd's other points in order, I welcome his agreement that *eidos* may refer to different levels of generality and cannot be always equated with essence. But I did not mean to say that essence is always teleological, which would be absurd (though I like the idea that to be musical is necessary to man) but that Aristotle seems to confine it to teleological features in the case of animals. Again it needs to be said that essence is not a thing, as the neoplatonists imagined, but is a label collecting those features which an X must possess in order to be an X,

and which mark out X from everything else. The controversial question is whether Aristotle also meant to confine essence to class-characteristics, as is suggested by *Melaph.* Δ 1016a32 and *G.A.* V.778a22, or envisaged individual essence as is suggested by 1029b14 and 1032a8. The most significant thing about this controversy is that Aristotle himself appears unaware of it: I shall return at the end of this paper to this dog that did not bark.

When Lloyd turns to *G.A.* IV I am surprised that he finds Aristotle's discussion of family resemblances "desperately indeterminate", for he gives a clear report of what seems to me an unusually clear and detailed discussion. Indeed interpreters who defend the belief that animal form is only class-form and is never individual usually find Aristotle's discussion here so painfully explicit that they try to dismiss it as an aberration. Lloyd does not go so far but, with all respect, I do think his subsequent analysis creates a muddle which is not in the original; and I think he oversteps probability when he tries to confine family likenesses to the features which Aristotle mentioned in refuting pangenesis in *G.A.* I, and when he suggests that if blue-eyed parents have blue-eyed children this is a coincidental outcome due entirely to the proximate matter. Moreover these non-teleological variations in eye-colour or hair or other pathemata, discussed in *G.A.* V, occur only in man and a few animals as Aristotle points out; in most they are regular — a given kind of animal has one kind of hair, one eye colour, one voice, one level of keen-sightedness or keen hearing — and all these differences are known to Aristotle as we see in *H.A.*; why then should sheep goats and cattle, all pasturing in the same grass, regularly produce their own characteristic pathemata, if not because eye colour is inherited? If in the goat, why not in the blue-eyed man? Aristotle points to the variations as evidence of the effect of material causes, for his argument in *G.A.* V is as always that animal features are a joint product of "nature and necessity". Lloyd over-emphasises the material factor and leaves nature out; but Aristotle continually mentions nature (779b2, 780a22, 780b10, 781b22, 23, 784a24, 784b4, 786a3, *passim*). The non-teleological pathemata are no more wholly produced by matter than are the teleological features, but both are liable to modification by matter. Lloyd also wishes to distinguish between the moving causes operating in matter and the formal causes. But there are moving causes on both sides of the equation. *G.A.* II argues carefully that the parent transmits potentially complex movements via the semen; these movements are then modified by other movements deriving from material interaction; hence the variabilities in parental likeness and occasionally even the loss of all likeness — but not in most cases. The way that nature "uses" matter is a theme of *G.A.* as of *P.A.*, and "nature" often refers not to finality but to the formal cause and

specifically to the soul-movements which control development (I have set out the evidence in "*Philosophical Issues...*" p. 292 sq.). The parallel that Aristotle draws with artefacts is closer than Lloyd allows: a cabinet-maker certainly has the material accidents in mind, else he could not select the appropriate timber; what he has not inside his mind is the timber itself, and herein he differs from nature.

On the question of definition Lloyd quotes the large number of remarks in *Metaph.* Z.10, 11, 15, which deny the possibility of defining the individual Socrates. I have in fact listed all these in my Appendix 1 in *Philosophical Issues* 302-306, and pointed out that these are the difficulties raised by Aristotle which lead one to regard *Metaph.* Z as deliberately aporetic, — not that these remarks will turn out to be untrue, but that they appear contradictory until further distinctions are made. This is a well-known device of Aristotle's, cf. the puzzle over defining water animals in *H.A.* VIII.2 and the eventual *prosdioristeon* 589b13. The aporia is: definition cannot take account of matter, yet man and other primary substances which above all should be definable must contain matter. It is inconceivable that Aristotle should have left the affair in this state of hopeless scepticism, so what and where is his solution? All the difficulties that he raises reduce to the impossibility of including matter in the definition, either because matter is posterior to form or more generally because matter is indeterminate. The objection to defining Socrates is not that he is individual but that he is material. If therefore there is some way of bringing matter into the formal logos (and sometimes Aristotle extends this by saying that movement too must be brought in, as at *Metaph.* E. 1025b30), then the aporia will be solved. And Aristotle then produces two ways. One (Z.17) is to show all four causes operating to make a single substantial object. Lloyd argues that this is invalidated by Aristotle's insistence that genesis is for the sake of ousia, not vice versa; but Aristotle's point is always that the final and formal causes are primary and cannot be ignored as the old scientists ignored them. In genesis they are logically prior because they explain why the genesis takes place, but their pre-existence is in *another* embodiment (parents) and he does not suggest that they could operate in genesis without or before the material and moving causes. Some parts too are logically and chronologically posterior to other parts during genesis (e.g. the kidneys are posterior to the heart, and the bladder to the kidneys), but in the completed ousia there is no longer any priority or posteriority among the parts (1038a33) but all together constitute a unity whose definition can also be a unity. The other way (H.6) is to recognise that within a sunolon both form and matter refer to the same objects, as I explained above. If Socrates is considered without regard to past or future he consists entirely of informed matter; at any one moment all

his matter is determined by form, and it is that form that can be defined. That is what I meant by saying that he has no matter at that moment: considered as unchanging he has no matter qua matter.

Lloyd's objection (if he means it seriously) to including Socrates's warts and bunions is not coherent. If the definition includes biped, then it must differentiate the feet and legs from those of birds; and if feet and legs, then it must also include the joints bones sinews and toes necessary for human movements; if these, then the flesh blood and vessels necessary to make and support them; if these, then a skin of suitable texture to contain and protect them; if skin out of *this* matter, then it will be liable to have warts and bunions. It is not necessary to remind Geoffrey Lloyd that Plato put a similar objection into the mouth of the juvenile Socrates, and gave a dignified response to *Parmenides* (130E) not unlike Aristotle's own rebuke at *P.A.* I.645a15 to those who found biological details contemptible.

Definition is of the soul in the case of animals, that is of the body's actualities. If *Metaph.* ZH is understood in the above way, there is no difficulty in making the definition of the soul include the workings of the stomach or the forming of warts, indeed it must include them. But Aristotle also maintains that definition is of the universal (in spite of his denial that universals are substance) and of the essence. Did he mean to exclude individual differences? Or did he assume that they were covered? Or is there a third possibility? So far as the wording of the definition is concerned, it is easy to formulate it in such a way that it holds both of the universal and of the individual and is comprehensive of both. For an animal definition must in any case be formulated with the use of disjunctives, since every *genos* divides into opposed *differentiae* (short/long feathers, etc.); by selecting the appropriate disjunctives in each case, we can use one universal definition to characterise both Callias and Socrates individually (eyes brown/blue/grey...), so that it will remain true that they are the same in form even though each has an individual form. The problem is not that it cannot be done, but that Aristotle did not do it; and as I have often said, putting words into Aristotle's mouth is usually fatal. I am not ready to attempt a clear position on this, but have a suggestion to make. Lloyd chides me for changing my mind over classification, which I must admit; and now over definition I hear the same creaking within. In the case of classification I thought for a long time that even though it is absent from the biology it must have been Aristotle's ultimate target. I no longer think so; there is no explicit renunciation of it, but it just ceases to be a possibility in the way that it certainly was a possibility in the Academy and in the *Topics*. It may be that definition was allowed to vanish too, and that Aristotle's target in natural philosophy is causal explanation. Apart from the problem of matter, he shows no sign that

individuation is a problem, and often it is not clear whether he is referring to individual or to universal: I believe that he commonly refers to both indifferently, except when he explicitly limits the reference in a particular context. In *G.A. V.1* he distinguishes those features which are due to finality and to the definition of being (i.e. essence) from those which are due only to matter and moving cause; then he proceeds to explain the latter, so showing that they are subject to episteme and to formal account, even though the account goes beyond the logos of the essence. In *H.A.* there is no distinction between features at any level, whether essential or universal or individual, whether *kalh' haulo* or *me kalh' haulo*. He says nothing as to whether they should be included in the definition and definition is not mentioned in *H.A.* In *P.A.* I he expresses the aim of diaeresis as "to grasp the form", but there he seems to halt division at the level of universal man or horse; this agrees with *Metaph. Δ 1016a32*, that a *genos* is not divided beyond the point where there is no further difference of essence. It may be that he saw no need to mention individual differentiae since a disjunctive definition of the universal will cover them anyway: similarly modern naturalists accommodate individual differences by defining the species in terms of the range of colours, sizes, etc. At the moment I hesitate, and shall again be chidden. Like Lloyd, I am reluctant to seek refuge in developmental hypotheses. But if I had the courage of a Pierre Pellegrin, who simply walked in and demolished classification with one blow, I should be tempted to say that definition and its associated logical apparatus became as irrelevant to Aristotle as it has done to modern philosophers of nature.

METAPHYSICS IN ARISTOTLE'S EMBRYOLOGY

JOHN M. COOPER

I. INTRODUCTORY

Traditionally, discussion of Aristotle's metaphysics, including his theory of form and the 'what it is to be' any given substantial object, has dealt extensively with relevant texts in the *Categories*, *Physics*, *De anima* and, of course, the *Metaphysics* itself. But the biological works have been largely neglected as sources for knowledge about and insight into Aristotle's theory.¹ This seems to me unfortunate. In his biological works Aristotle invokes the form of an animal constantly and in interesting physical and, one would have said, metaphysical detail, as the explanation for much, and that the crucial part, of what happens to it as it develops to maturity and maintains and reproduces itself. One would expect these explanations to reveal something about the character of Aristotelian forms and perhaps even to help resolve some of the many questions not clearly settled by him in his metaphysical writings. It might, I suppose, be argued, on the contrary, that Aristotle thought that the notion of form needed for metaphysical purposes is quite distinct from that needed in order to explain the biological phenomena addressed in the *Parts* and the *Generation of Animals*. Conceivably there is no, or only a very loose, systematic connection between what is said about forms in the two sets of works, so that one is not entitled to infer metaphysical consequences

(1) An important exception to this general rule are two papers by D. M. Balme, 'Aristotle's biology was not essentialist', *Archiv für Geschichte der Philosophie* 62 (1980) 1-12, and 'The snub', *Ancient Philosophy* 4 (1984) 1-8, now revised and reprinted in A. Gotthelf and J. G. Lennox (eds.), *Philosophical Issues in Aristotle's Biology* (1987) 291-312.

— consequences for the nature of forms as they appear and are argued about on metaphysical terrain — from what forms are taken to be like in the biological context. I will not attempt to argue against this line of interpretation here. In the belief that the philosophical interest of doing so will be sufficient justification, I will simply proceed on the natural assumption that Aristotle did intend his biological theory of forms to be a continuous development and extension of whatever theory of substantial forms he meant to be the upshot of his discussion in the central books of the *Metaphysics*.²

I want to focus upon Aristotle's theory of animal reproduction and embryology in the *Generation of Animals* (*GA*) — his account of how an offspring is brought into being and made to resemble other members of its species in general, as well as its parents and various of its ancestors in particular. As is well known, Aristotle holds that it is a parent's form (more specifically, the father's form) that controls the offspring's formation as a member of the same species. But in that process, it also regularly happens that there come to be parental and more generally familial resemblances in the specific ways in which form becomes realized in the offspring. It is perhaps less well known that Aristotle holds that the parental form controls those resemblances, or some of them, as well. To the extent that the parental form is responsible for resemblances to parents and ancestors going beyond mere membership in the same species, and that these resemblances are not due instead to characteristics of the matter on which the form works, or to environmental conditions during or after gestation, one would apparently have to attribute to the parental form certain determinate powers that go beyond those that could belong to a form merely in virtue of the fact that it was a form of a member of that species. In that case the parent's form would have to be, not species-specific merely, but in some additional degree specific for particular further characteristics of bodily structure and organization — whichever ones require to be explained as deriving directly from the parent's formative rôle in generating the offspring.

Now this result does not sit well with either of the two currently most favoured interpretations of the theory of substantial form to be found in Aristotle's metaphysical writings. Many who write on Aristotle's metaphysics seem almost to take it for granted that Aristotelian forms go with species, with natural kinds, one for each. Yet those who have recently revived the ancient interpretation according to which each individual substance has its own individual form, have tended to hold that the features that distinguish one

(2) It is a matter of indifference for my discussion what the order of composition of these works may have been.

individual form from another, for members of the same species, lie outside the form itself as accidental properties of the substance whose form it is.³ If I am right, neither of these interpretations can accommodate the evidence for his conception of forms provided by Aristotle's embryology. In order to show this it will be necessary first to consider that evidence in considerable detail.

II. ARISTOTLE'S THEORY OF ANIMAL REPRODUCTION

In the discussions making up the first three books of the *GA* Aristotle's principal goal is to explain what Montgomery Furth has called the 'whacking great a posteriori truth' that generation is normally reproduction, that animal offspring (occasional monstrous births aside) always belong to the same species as their two parents.⁴ He explains this by the theory that the father's sperm, which is the causal agent active in generation, carries certain specific movements (*κινήσεις*) that are such as to shape the material that the mother provides in her womb into a member of the same species (and into nothing else that could survive). It does this by passing on to the offspring 'the same movement with which it too is moved' (II, 3.737a20-1). For this movement in the father's sperm (or, more accurately, as we shall see, these movements) is derived from those that are present in his blood: it is from the further 'concoction' and concentration of his blood that the sperm is produced. As the form that makes the father a human being is carried by these movements in his blood, it is easily understood that these same movements in the sperm are such as to make, if anything at all, another thing of the same species as the father. Now it is essential in understanding Aristotle's theory to make note of the fact that, on his account, what I have just said about the male sperm's relation to the father's blood holds equally of the female's menstrual fluid in relation to her blood. The menstrual fluid is also a 'seminal residue' (*σπερματικὸν περίττωμα*), less concocted and less pure than sperm, and so not capable of generating anything, i.e. not capable of coming alive by itself or making anything else come alive (I, 20.728a18, 26; II, 3.737a27-30; II, 7.746b26-9).⁵ Both these seminal fluids are derived from that element

(3) See Michael Frede, 'Substance in Aristotle's *Metaphysics*', in his *Essays in Ancient Philosophy* (1987) 72-80 and his and Günther Patzig's edition, German translation and commentary on *Metaphysics Z* (1988).

(4) See his *Substance, Form and Psyche* (1988).

(5) Although, as these passages witness, Aristotle often refers to both the menstrual fluid and the semen as *sperma*, he also often (most notably in *GA* I, 17, when raising the question whether both the male and the female contribute something that then works to structure and form the embryo) uses this word more narrowly, to refer to what does do the work of structuring the embryo (and on his view not the female fluid, but only the male, does that).

in the adult's blood that 'provides being both to the whole (animal) and to its parts', the kind of blood that Aristotle calls *θρεπτικόν* (and *σπερματικόν*) and distinguishes from the *αύξητικόν* or growth-producing kind (II, 6.744b32-8). Accordingly, in both sexes the seminal fluid contains the full range of movements that the 'nutritive' blood itself does, by which it was able to form all the bodily parts of the animal whose blood it is. It is this movement, as it occurs in the blood, that carries the 'programme' for all the specific tissues and organs that an animal of the kind in question has to have. That is why in the different, stronger form in which it occurs in the sperm, it carries this same 'programme', but in such a way as to pass it on to the foetus, as that takes shape in the mother's womb. What, however, is the function of the menstrual fluids or *καταμήνια* and their movements in this process? At this stage (in books I and II) Aristotle says little about this, but the implications of his general theory of the formation of seminal fluids by further concoction of the *θρεπτικόν* or nutritive kind of blood, taken together with what little he does say about the rôle of the catamenia, make this clear enough. For Aristotle describes a progression in three distinct stages: from (1) the nutritive kind of blood to (2) the less pure, less fully concocted and 'worked up' seminal fluid of the female (cf. *δεόμενον ἐργασίας* 728a27) to (3) the fully concocted, form-transmitting seminal fluid of the male. The female fluid is therefore somehow intermediate between nutritive blood and honest-to-god semen, and this intermediate status that Aristotle assigns it in books I and II has clear implications about its function in generation.

First of all, it must be remembered that nutritive blood is the *material* from which the tissues and organs are composed. As nutriment, it is absorbed by, it turns *into* those tissues and organs. The way in which this blood carries the 'programme' for the tissues and organs is as matter having a principle (in fact, presumably, the *σύμφορον πνεῦμα*) internal to it which causes it to take on the appropriate shapes and textures, etc., at the right places and times. Now one thing Aristotle says clearly and repeatedly about the catamenia is that they are the material on which the male fluid works in order to form the foetation (= the proto-embryo — *κύημα*). And bearing in mind the catamenia's origin in nutritive blood, one can see why just this material is what is required. Presumably, only a material which already was such as to be formed into organs and tissues of the types required would be suitable. For example, human semen does nothing when juxtaposed with a female dog's catamenia, because a dog's catamenia are themselves definitely disposed to be made into a dog embryo or into nothing at all organic. Hence Aristotle says (II, 3.737a23-4) that the catamenia are potentially all the bodily parts of the creature that is to be constructed out of them, but actually none of them. The menstrual

fluid is potentially all those parts, because it is derived from the nutritive blood of another member of the same species, and retains from that blood just those movements that are specific for those parts (cf. 738a37-b4: the menstrual fluid is suited to be turned into a new creature of the same species, because it was already potentially material for the mother's body). Both in nutritive blood and in the catamenia these movements are movements of *matter*; they function as movements belonging to blood and to catamenia as *matter* for what is made out of them. Blood is matter for the animal itself whose blood it is; catamenia are matter for a new animal of the same species.

The seminal fluid of the male, however, has these same movements not as matter for a new animal, but as the source of its form (765b11). This means that it can make something formed from catamenia of the appropriate kind actually come alive, i.e., come to possess an independent source of its own self-regulation, including most crucially the source of its own capacity to make its *own* nutritive blood (also its own auxetic blood).⁶ The movements within the new creature's blood that are the physical realization of this capacity are given to it by the father, not by the mother, even though if the catamenia contributed by the mother did not have, as matter, the appropriate movements, the father using the instrument of *his* seminal fluid could not have caused it to come alive and so to come to possess that capacity.

III. SEXUAL DIFFERENTIATION: MASTERY AND BEING MASTERED

So far I have limited myself to summarizing Aristotle's theory of reproduction as this is presented in the first two books of the *GA*. I have said nothing about particular or individual vs. merely species-specific forms, because all that Aristotle is wanting to explain in these books is why offspring belong to the same species as their parents. It is only when in book IV he attempts to give detailed explanations of the processes by which female births and inherited resemblances to parents and grandparents occur that he reaches a level of fact to which this

(6) But only if there is a *συμμετρία*, a suitable balance or 'symmetry' between its heat and movements and the wetness and quantities of the catamenia that it works upon. Aristotle emphasizes the need for this 'symmetry' as early as I, 18.723a28-31: see also 729a16-19, 743a26-34, 772a10-22, 777b27-9 and especially 767a13-35, discussed below p. 67. As Aristotle often makes explicit in these passages (729a17, 767a17-20, 772a11-12), this is a symmetry between an active factor in generation (the male) and a passive one (the material provided by the female). His talk of symmetry in this connection does not imply any kind of interaction between the two factors, in the sense of a joint working together by two independent but proportionately coordinated agents with a view to a common product.

distinction might be relevant. I turn now to consider Aristotle's account of those processes.

Book iv opens by proposing for investigation (763b25ff.) the question how sexual differentiation comes about. When, however, after discussing the views of some of his predecessors on this question, Aristotle presents his own account (765b6 to the end of chapter 1) he invokes principles that, as he remarks at the beginning of chapter 3 (αἱ δ' αὐταὶ αἰτίαι καὶ τοῦ τὰ μὲν ὁμοκότα γίνεσθαι τοῖς τεκνώσασιν τὰ δὲ μὴ ὁμοκότα, 767a36-7), also provide the explanation for the fact that some offspring resemble their fathers or their fathers' (male) ancestors, others their mothers or their mothers' (female) ancestors, either in overall structure and constitution and/or in that of certain bodily parts, while yet others show no particular resemblance to their forebears at all (767a36b-b5).⁷ And once he has discussed and offered his own explanation of the phenomena of inheritance, he summarizes his results by claiming that he has revealed a common cause for sexual differentiation together with these varied facts of inheritance (769a1-6). In order to understand fully what this common cause is, we need to begin by considering the passage of iv, 1 where it is first introduced, in connection (so far) only with sexual differentiation.

At 766a10-16 Aristotle lists some principles on which he says sexual differentiation depends, of which, however, only the last seems to play any significant rôle in the explanation he goes on to provide. This last principle runs as follows (a14-16): 'Given that destruction (of a thing) is into (its) opposite, necessarily also what is not mastered by the agent that is working it up (τοῦ δημιουργοῦντος) changes into the opposite condition'. Applied to the case of generation this means that if the male fluid and its movements fail to master the catamenial materials on which they are working to form the offspring, these materials will change (from being the male that they would have become if the male fluid had mastered them) to being the opposite of a male, viz. a female. What, however, is the cause of this failure by the male fluid to master the female? What in the nature of these fluids and the action of the one and reaction of the other causes this change in the materials? Aristotle gives a detailed answer to these questions only in chapter 3. There he introduces, for the first time in the whole treatise, (a) a differential account of the various movements that are to be found actually and potentially in the male's fluid, and (b) an *explicit* rôle for somehow corresponding movements in the female's fluid. Ultimately we will have to look closely at this account of the *several* male and female movements and their interactions in order to understand what

(7) He says also that the same principles explain monstrous births offspring that are animals but not regular human beings at all. I do not discuss this extension of the theory.

Aristotle thinks causes this change. But already in chapter 1 two important points are clear.

First, the rôle of the female fluid remains, as in book ii, wholly a rôle as matter. This is made explicit at 766b12-14, which (abstracting from textual difficulties which do not affect the main point) clearly says that it is only the male fluid that possesses a principle capable of setting in motion and shaping the female fluid into a foetus; the female's fluid is matter only. So when Aristotle says the male's fluid fails to master, or is defeated (ἡττηθῆναι 766a20; cf. κρατηθῆναι b15, κρατηθέντος 768a34) in its efforts to master these materials, and so the materials are shaped into a female, he does not mean that some independent active, generative activity of the female materials takes over. The movements in the female materials are not a new, second set of movements, parallel to the movements in the male's fluid, that directly shape the foetus' bodily parts, as it were by default. Both before and after his discussion in iv of female births and inherited resemblances to ancestors Aristotle repeatedly emphasizes that only the male, through the movements in his semen, is capable in any way at all of fashioning (δημιουργεῖν) the materials provided by the female into a new animal (i, 22.730b4-32; ii, 4.738b12-15, 20-3; iv, 4.771b21-4, 772b31-3), and three times in the course of this discussion he characterizes the male, by contrast with the female, as the δημιουργοῦν (766a15, 767a19, 768a16). So whatever the rôle of the female fluid's movements may be, it is not they, but the movements of the semen, that impose on the embryo its female soul and those specific movements in its body that are its soul's physical realization and that make it develop as a female.

Secondly, we already have in chapter 1 an important indication of what happens that causes the change of sex. In the passage already cited where he states his general principle about materials that are not mastered, Aristotle speaks, naturally enough (at 766a15-16) of these materials themselves changing into the opposite (of what they would have changed into if mastery had been achieved): they μεταβάλλειν εἰς τὸναντίον. That, after all, is what has to be explained. But at 766b15-16, immediately after saying the female fluid is matter only and only the male's fluid is active and formative, he says this change in the materials is preceded and caused by a change in the male fluid itself: 'so when it (the male fluid) has the mastery, it takes it (the female matter) over to itself, but when it is mastered, it (still the male fluid) changes to the opposite or else to extinction (εἰς τὸναντίον μεταβάλλει ἢ εἰς φθοράν). Indeed he had already said this at 766a18-21, where however it is possible not to catch the point. For the subject of μεταβάλλειν there *could*, by a remote possibility, be the materials that are the understood object of the verb ἀγάγει in the previous clause (that is how Peck renders the lines) though by the rules of Greek grammar it ought to be the male

ἀρχή, the subject of ἀγάγη.⁸ But at 766b15-16 this meaning is unmistakable: the defeat of the male fluid by the female fluid means that the *male fluid itself* in its working up of the materials is affected in such a way that it turns them into a female (and see 767b22-3: the *male movements* bring about, ποιεῖν, this deficiency in the offspring). That is what it must mean to say that the male fluid 'changes to the opposite' (on this, see further below): it changes so as to do the opposite of what it would otherwise have done.

IV. ACTUAL AND POTENTIAL MOVEMENTS IN THE SEMEN

For the elaboration of this theory we have to turn to chapter 3. So far Aristotle has only said that sometimes the male fluid (or its movements — at 767b18-20 he says that it comes to the same thing whichever of these one says) fails to master the female fluid that serves as original matter for the foetus, and that when this happens a female birth results. This, however, as he now points out, is an over-general remark. For distinctions can be made among the movements of the sperm, and it is only when *certain* of these movements are mastered that a female birth results. There are, first of all, its actual movements, and then some that it has only potentially (767b35-37, 768a12): I will explain what this distinction comes to in a moment. Secondly, both the actual and the potential movements can be divided into movements at different levels. In explaining the different levels of the actual movements, Aristotle says the following.

The sperm of any individual male animal, say Coriscus or Socrates, has movements that belong to it (1) as movements of this particular individual qua father, (2) as movements of a male, (3) as movements of a human being and (4) as movements of an animal (767b25-32; 768a12-13 says these are *actual* movements). So in the case of a female birth, it is not the movements of the father's sperm, in general, that get mastered, but more precisely, those belonging to it as (2) movements of a male. It may happen that *these* movements are mastered (so that a female birth results) while nonetheless (1) the movements it has as this particular individual qua father are not. When that happens, a female offspring

(8) In both these passages I take it that μεταβάλλειν is being used intransitively, as elsewhere in this context (766a16, 23-4; 768a14). A survey of Aristotle's usage shows that where he does use μεταβάλλειν transitively the object of the verb is almost always the respect in which the thing in question changes, almost never some other person or thing on which it effects a change. (The only clear instances of this latter kind that I have found are at *HA* 592a15 and *Poet.* 1459b41.) So Aristotle's words here do not mean that the male fluid 'changes the female fluid to the opposite or to extinction'.

results, but one resembling the father. In accordance with the general principle enunciated in chapter 1, when the father's fluid fails to master the mother's with respect to its movements (2), the material being worked on 'goes over' (ἐξίσταται) to the opposite, i.e. in this case, to being a female instead of a male (768a2-7) — because, not achieving mastery, the father's fluid 'makes it deficient in that faculty in respect of which it failed to gain mastery' (767b22-3). But since the sperm masters the material with respect to the movements (1), there is no 'going over' to an opposite in the relevant respect, and so we get an offspring (a female one) resembling the father.

Likewise, as Aristotle says is the more usual thing, it can happen that the sperm is defeated simultaneously with respect to both movements (1) and (2). The result is that it makes a female resembling her mother (768a24-6) — resemblance to her mother being the opposite of that resemblance to her father which is prevented when the movements (1) are defeated. By distinguishing movements (1) and (2) and allowing that the male fluid can achieve mastery, or not, with respect to these movements independently of one another, Aristotle can explain both how female births occur, and how a female may resemble either her mother or her father. Exactly similarly, he can also explain how a male child may resemble his mother, rather than his father: because the movements (1) are defeated he resembles his mother, the opposite of the resemblance to his father that the mastery of the movements (1) would have caused.

Before pursuing further elaborations, let us pause to note one crucial point. By saying that there are actually in any male animal's sperm movements belonging to it as that individual qua father Aristotle commits himself to at least the relative particularity of that animal's form. It is through the movements in its sperm, the same movements that were in its blood and conveyed its form to its own matter, that an animal conveys form to the offspring, and if these movements include ones that belong to it as an individual father (whatever exactly the extent of the individual features in question turns out to be), then the father's form is not one that could be shared by all other animals of the same species, or even all the males. Aristotle already makes this clear in book iv chapter 1, when he says that if all goes well the father, using the instrument of his sperm, brings the female matter over to his own peculiar form (εἰς τὸ ἴδιον εἶδος τὸ αὐτοῦ 766a19-20), i.e. to possessing the capacity and tendency, as an independent living thing, to develop in such a way as to have those same features, whichever they are, that characterize the father as an individual and belong to him qua having that form.

So far I have discussed only the actual movements in the sperm. But there are potential ones as well, Aristotle says. First of

all, an animal's sperm has potentially the movements of its πρόγονοι, i.e. its father, its father's father and other male ancestors in the male line (767b37, 768a11, 16-18). It has these as potentialities of its movements (1), the movements that it possesses as being the sperm of this individual qua father. These potentialities can be realized when the sperm nonetheless achieves mastery with respect to the movements (1), and in fact only then. In that case one gets an offspring [whether male or female: sexual differentiation, as we have seen, is determined solely by whether mastery is achieved with respect to movements (2)] resembling *not* the father, but the father's father, or the father's father's father (and so on backward). This depends upon the phenomenon that Aristotle describes (first at 768a15) as the λύσις, the loosening or slackening, of the movements (1); a lesser λύσις means that the offspring comes to resemble an ancestor nearer the father, a greater one means resemblance to a more distant ancestor in this series (768b9-10).

But Aristotle seems to say that a male animal's sperm has potentially a second set of movements. At 768a14 he says it has potentially the movements of the female, by which I believe he refers to the *mother* of the prospective offspring.⁹ That is, the sperm has in some sort of potential way the movements of the menstrual fluid of the female with which the male copulates. Now, as he goes on to say, the movements of the female animal's seminal fluid that belong to her fluid as that individual mother [i.e. its movements (1)] can also suffer loosening or slackening, just as the male's movements (1) can.¹⁰ The result is parallel to what happens in the case of the slackening of the male's movements (1). When, but *only* when, the male's movements (1) are mastered (or, equivalently, fail to gain the mastery), instead of an offspring (whether male or female) resembling the mother being

(9) Taken out of context 'the movements of the female' might, I think, be given any of three interpretations: (1) the movements belonging to the menstrual fluid, (2) the movements (belonging to the semen) that are such as to fashion a female (compare 768a32, ἡ (κίνησις) τοῦ Σωκράτους and τὴν τοῦ πατρός) (3) the movements (belonging to the semen) that correspond to those both actually and potentially present in the mother's menstrual fluid. I argue in the next two paragraphs against opting for interpretation (1) in this context. I prefer (3) to (2) because I understand Aristotle's purpose in these lines (to 768a21) to be to explain how the semen can be responsible for fashioning not just a female (as (2) would permit) but one resembling her mother or any of her mother's forebears — the movements characteristic of whom are of course in the mother's menstrual fluid either actually or potentially. But on either of these two interpretations the basic principle is the same: Aristotle attributes to the semen, as a potential movement of its own, a movement it is going to put actually into the embryo in fashioning it.

(10) Since Aristotle only explicitly mentions movements in the catamenia while discussing the phenomenon he calls λύσις, which only operates on movements (1), he never has occasion to attribute to the female fluid movements (2), (3) and (4). On general grounds we can infer he must suppose these other movements are present too.

produced, it can happen that we get an offspring resembling the mother's mother, or the mother's mother's mother, instead. Here one gets a combination of both of the two basic processes that Aristotle postulates. First, the female fluid acts on the male fluid's movements (1) and defeats them so that they ἐξίστανται, depart from their own nature, and therefore make an offspring resembling not himself but the opposite of himself. But now, there is in addition a λύσις in the victorious female fluid, and so the potentiality in the male's sperm to make an offspring like the mother's *mother* (instead of like *her*) gets actualized. That is, it appears, Aristotle attributes to the male fluid, somehow in potentiality, all the movements that are in the female parent's seminal fluid — both those characteristic of her as an individual parent and those movements of all her female ancestors that she herself carries only potentially.

Now this is not as strange an idea as it may seem on first presentation. As we will see shortly it has a deep rationale in Aristotle's theory of the rôle of the male as what alone fashions the offspring and gives it its soul or form. Moreover, it can be defended on the basis of general considerations about any process of fashioning something, whether by art or by nature. There is nothing outlandish or extravagant here at all, once Aristotle's idea is fully and properly understood.

V. FEMALE MOVEMENTS IN CATAMENIA AND SEMEN

But first I want to show through a detailed consideration of the text of *GA* IV, 3 that it really is Aristotle's view that the male animal's semen possesses somehow in potentiality the movements of the prospective mother of its offspring. In the penultimate paragraph above I cited 768a14 as explicitly affirming this view, but we will need to consider as a whole the long opening paragraph of the chapter (to 768a21), in which Aristotle formally sets out all the fundamental elements of his theory, this one included. The sentence at 768a11-14 reads: 'Some of the movements (in the seminal fluid) are present in actuality, others in potentiality: in actuality, those of the male parent and of the universal, such as a human being and an animal; in potentiality, those of the female and of the ancestors.' Now (I will return to this point below) the preceding context makes it overwhelmingly likely that the seminal fluid whose actual and potential movements Aristotle here means to be talking about is the male's fluid — the fluid that shapes and fashions the embryo, and that has clearly been the only subject of his discussion in the chapter up to this point. (That is why Peck does not go beyond what the Greek justifies when he translates 'Some of the movements...

are present in [the semen] *in actuality*...').¹¹ If so, as I have claimed, Aristotle here explicitly states that the semen has, as a potentiality, the movements of the female, evidently (see n. 9 above) meaning those of the mother — the ones that, when actualized, will fashion an offspring resembling the mother or one of her ancestors. On the other hand, as I have also said, Aristotle clearly does introduce in this chapter, for the first time explicitly anywhere in the treatise, movements in the menstrual fluid that somehow correspond to the movements of the semen (though he continues to hold that only the male's movements are such as to fashion, shape and constitute the offspring). Indeed he does this only four lines below (768a18-21), saying that just as the male parent's movements, when they relapse, relapse first into those of his father, or if not, into those of his grandfather, so the mother's relapse into those of her mother, or if not into those of her grandmother. Perhaps then he already has this parallel between male and female movements in mind in what precedes. In that case one might suggest that the fluid whose movements Aristotle means to be discussing at 768a11-14 is not the male fluid only, as I have taken it, but seminal fluid in general — both the male's and the female's, together. Perhaps, then, in speaking of 'the movements of the female' Aristotle here speaks not of movements even only potentially in the male fluid, but simply of the movements in the menstrual fluid itself.

On this suggestion, he will be saying that some movements in the generative fluids (in general) are present actually, others potentially only: actually present (viz. in the *male's* fluid) are the movements of the male parent and the universals, a human being and an animal, but potentially present (viz. in the *female's* fluid) are all those of the mother — those it has as movements of this particular individual qua mother, and as movements of a female, a human being and an animal — *and also* (viz. in *both* fluids) those of the respective ancestors. This, however, makes little sense. (i) Exactly the same ground for saying, as Aristotle already explicitly did at 767b35-7, that the movements of the male parent as that parent, a male, a human being and an animal are present *in actuality* in his semen, apply also to the corresponding movements of the female. So what possible reason could Aristotle have for saying that though the male's movements are present in actuality, the corresponding ones of the female are only there in potentiality? (ii) In any event, it is quite clear what the contrast between actuality and potentiality comes to in its present application. It is first introduced at 767b35-7, where the movements of his ancestors are said to be present in a male's semen potentially, by contrast with those actual ones belonging

(11) The French translation of P. Louis agrees with Peck at this point.

to it as himself, a male, etc. The thought clearly is that the potential ones are underlying movements that become active when, as with the postulated phenomenon of λύσις, the normally active ones give way. And that is certainly how it is to be taken in reference to the movements of the ancestors mentioned at the end of our sentence. But if in the female's fluid the movements of her ancestors are in this sense merely potential, that must be by contrast with the movements they replace if λύσις occurs, viz., the ones characteristic of her as an individual mother; and these ought therefore to be *actual* movements of the fluid, not a second set of potential ones instead, as they become on this interpretation of the sentence. One might try to find some other use of the word 'potentially', according to which Aristotle might plausibly have thought that even the movements belonging to a woman's menstrual fluid as that individual are present in it only potentially.¹² But that would require taking the single word δυνάμει at 768a13-14 in two different senses — one for the movements 'of the female' and one for those 'of the ancestors'; and one of these senses would have no warrant at all in the evidently parallel uses of the term elsewhere in this chapter. It is impossible, then, to make good sense of this sentence on the supposition that in it Aristotle is discussing movements in both the generative fluids.

In any event, the context makes it clear that at 768a11-14 Aristotle is referring only to movements in the male's fluid, and that explicit reference to movements in the female fluid only occurs for the first time just afterwards, at 768a19-21. In chapter 1, as I have explained, Aristotle introduces the central idea on which he will ground his detailed explanations — the idea that the male, active, fashioning agent in generation can nonetheless fail to master the female, passive, material element (or, equivalently, be defeated by it). The reason he gives (at 766a19) for this defeat is that the semen is deficient in heat and so cannot concoct the catamenia to such an extent as to make them turn into another male (and, it is implied, one like the father, a19-21). In the next chapter he explains in more detail that success or failure in mastery depends really on the συμμετρία (balance, proportion) or its absence between the semen and the menstrual fluid (767a15ff.). The heat of the semen must be in the right proportion to the moistness (and cold) of the

(12) One might think, as Geoffrey Lloyd has suggested to me, of Aristotle's remarks at e.g. 737a22-34, 738b3-4, 740b18-20, to the effect that the material contributed by the female is already potentially, though of course not actually, all the bodily parts that the male will fashion it into. But these remarks hardly yield a sense in which the movements in the menstrual fluid, that are in fact Aristotle's ground for saying that it is potentially all those bodily parts, are not present in it actually, but only potentially; indeed, they imply precisely the contrary.

menstrual fluid if there is to be any 'setting' of an embryo at all. If the particular semen is too hot for the given catamenia, it will just boil them away and dry them up; if not hot enough no congealing will take place at all. And likewise the exact proportions in heat and wetness of the two seminal fluids will be responsible for whether a male or a female is produced. Both his talk of the semen as sometimes mastering but sometimes being mastered by the catamenia, and these comments on the need for 'symmetry' between the two fluids, make it clear already in chapters 1 and 2 that Aristotle is going to assign an important rôle to the female fluid in determining the sex and (we may add by anticipation) the inherited resemblances of the offspring. But although he has spoken repeatedly and from very early on in the treatise about generative movements in the semen he has not yet openly mentioned movements in the menstrual fluid at all, much less any rôle they might play in this connection. Indeed, his talk of a *συμμετρία* in the fluids' heat and wetness rather discourages the reader from thinking of corresponding, and somehow themselves operative, symmetrical *movements* on the female side: wetness, unlike heat, certainly does not connote movement in Aristotle's physical theory. It cannot be emphasized too strongly that, however much the theoretical basis for them has already been laid in book II, no actual mention of movements in the catamenia, much less of any rôle for them in sex-determination and inherited bodily characteristics, has occurred before *GA* iv, 3.

Aristotle initiates the exposition of his own theory in *GA* iv, 3 by reminding the reader of the two principal things he has said already about the causes of female births. It is possible, he says (767b10-13), for the male sometimes not to master the female fluid, with a resulting female birth, through youth or old age or some such cause — youth and old age were mentioned at the beginning of chapter 2, 766b28-31, as being responsible for those deficiencies in the heat of the semen that at 766a19 he said explained its failure to concoct the catamenia sufficiently and so to 'master' them. Thus he begins by continuing to focus exclusively on the semen and defects in it that lead to its failure to produce a male offspring. 'For,' he says (767b15-18), 'when the spermatic residue [viz., the semen]¹³ in the catamenia is well-concocted

(13) The *σπερματική περίττωσις* referred to here as being in the catamenia must be the semen, and not the female fluid itself, for two reasons. (i) This sentence supplements the statement at 767b10-13 just before about what causes a female birth, by stating the cause of the contrasting male birth. Since the female birth was said there to be caused by a defect in the hotness of the semen, we need a reference here to the well-concoctedness, and so hotness, of the semen as what causes the male birth. (ii) In the following sentence Aristotle makes a remark about the equivalency of speaking in such contexts of either the semen (*γόνι*) or the movement (in it), and the relevance of that remark *here* is heightened by, if it does not actually require, a reference to the semen in the first part of this

[and so sufficiently hot] the movement of the male will make the [embryo's] shape like his own.' He then makes the important generalizing remark I have quoted already, that when the semen *fails* to master the female fluid it is nonetheless the semen that makes the embryo have a 'deficiency' in precisely the respect that is controlled by the 'capacity' in which it failed to master it — the *semen* fashions the offspring so that it is a female, or resembles its mother. He goes on to detail various 'capacities' of the semen (767b23-35), adding at b35-7 that in addition to actual movements from its capacities for the individual characteristics of the father, a male, a human being, and an animal, the semen has present in it in a potential way the movements of his ancestors. There is no reference yet to movements in the catamenia, nor has Aristotle yet even opened up the theoretical space into which they might be fitted. After all, he posed the problem he is now solving in terms of how the semen produces the effects it is seen to produce (*ποιήσει*, 767b17, 21 *ποιεῖ* 23), and it is only natural that he has gone on to explain them by telling us about the semen — about 'capacities' and movements in it, such that it produces one result if they achieve mastery and the other if they do not. Up to this point it is exclusively the semen's capacities and movements that he has told us anything about.

The mention of the male's ancestors at 767b37 introduces the concept of potential movements, and with it the second of Aristotle's two postulated processes, that of the loosening or slackening of the movements. For the movements of the ancestors, which are potential movements, get progressively made actual (first those of the grandparent, then those of the great-grandparent, and so on) as the movements that are in the father's semen as that individual parent themselves undergo a lesser or a greater slackening or loosening (cf. 768a16-18, b8-10). It is only when he comes round to explaining this slackening of movements and consequent resemblance to ancestors, instead of to parents, that Aristotle opens up the theoretical space into which movements in the female matter might be placed. 'And' he says

sentence. Read that way, Aristotle does precisely begin by speaking at 767b15 of the well-concoctedness of the *semen* only to conclude by saying (b17-18) what, when it is well concocted, the *movement* of the male will effect; the remark at b18-20 is then fully in place, as indicating that no gap has in fact been left open in the explanation just given between the semen (and its features) and the formative movements. I have been unable to find any exact parallel for the expression *ἡ περίττωσις ἐν τοῖς καταμήνιους ἢ σπερματικῇ* (referring either to the semen or to the female generative residue), but Aristotle does of course speak frequently enough of a mixture of the two residues when conception occurs (e.g. 728a29-30), and he does occasionally mention semen being in the catamenia under such circumstances (e.g. 727a17-18). So neither Aristotle's usage nor his general theoretical position throws up any obstacle to finding here the reference to the semen that the surrounding context requires.

(768a9-11), 'similarly for the faculties next in line. For it [sc. the matter from which the offspring is being made] always tends to go over to that one of the ancestors that stands next in line, both on the father's side and on the mother's.' In order to explain the offspring's 'going over' to the mother's ancestors Aristotle proceeds to assign an explicit rôle to movements in the female residue. But first, in accordance with his general theory and in continuation of what he has been saying immediately before (768a2-9), where he has repeated his account of how the semen fashions the offspring into a female and/or a person resembling the mother, he points out that the semen itself contains, in potentiality if not actuality, all the movements that are necessary to it if it is to do all these jobs — the movements of the female, along with those of his own and her ancestors. This is our sentence at 768a11-14, quoted above: 'Some of the movements (in the seminal fluid) are present in actuality, others in potentiality: in actuality, those of the male parent and of the universal, such as a human being and an animal; in potentiality, those of the female and of the ancestors.'¹⁴ Only then does he go on, in giving details of how resemblance to ancestors on either side is produced, to introduce into his explanation movements in the female residue itself.

So then, when it [sc. the matter from which the offspring is being made] departs from its own nature, it changes over into the opposites. But the movements that are fashioning [the offspring] slacken into the nearby movements, for example if the movement of the male parent slackens, it goes over by the smallest variation to the movement of his father, or in the second place to that of his grandfather. And in this way too on the side of the females,¹⁵ the movement of the female parent goes over to that of her mother, or if not to that, then to the movement of her grandmother. And similarly also for the more distant ancestors. (768a14-21)

(14) Notice that the unexpressed dative with *ἐνεῖται* at 768a11 'the movements in... are present') is to be supplied from the dative at 767b35-6, *ὑπάρχουσιν αἱ κινήσεις ἐν τοῖς σπέρμασιν*, which in fact this sentence partially repeats. Since *σπέρμασιν* at 767b36 is the semen (only), so must the intended reference to seminal fluid at 768a11 be. This is added confirmation, if any were needed, for my interpretation of this sentence. (The fact that at 768b4 and 6 the implied dative with *ἐνεῖται* includes both the semen and the female residue is irrelevant to the interpretation of *ἐνεῖται* at 768a11. Once movements in the female fluid are introduced into Aristotle's account, at 768a18-21, they obviously fall within the scope of the general principles about actual and potential movements first set out for the male fluid alone at 767b35-7 and 768a11-14, and he simply takes note of this fact at 768b4 and 6).

(15) I translate Drossaart Lulofs's text. But I wonder whether one ought, instead of excising *καὶ ἐπὶ τῶν ἀρρένων* with Drossaart Lulofs, or excising this together with *καὶ ἐπὶ τῶν θηλείων* with other editors, to retain the manuscript reading, changing only the second *καὶ* of a 18 to *ὥστερ*, thus giving the sense: 'And in this way too, on the side of the females as on that of the males...'. Our mss. might have resulted from a scribe's having been misled by *καὶ ἐπὶ πατέρων καὶ ἐπὶ μητέρων* at a 11 to repeat that construction here by altering *ὥστερ* to *καὶ*.

Aristotle does not immediately explain (but see 768b15-25, and my comments below, pp. 75ff.) why he needs both the potential movements in the semen and these corresponding ones in the catamenia, but the reason is clear enough. On his view, reaffirmed in this chapter at 768b16 and 25-7, the semen is the active, formative agent, the catamenia the passive material in the generative process. As being the material from which the offspring is constructed the catamenia cannot initiate any of the movements that fashion the offspring, or determine directly the course which any of these movements take. Aristotle points out two ways in which the catamenia can nonetheless affect these processes by affecting the semen itself, which is the source of them. First (see 768b25-7) it can be too cold or too great in amount for the semen to work it up fully according to its natural tendencies (i.e. it can cause the semen to fail to master it). One way this can happen is for the semen to be unable to make the offspring resemble the male whose semen it is, and then, as Aristotle has already explained, it makes the material go over to resembling the mother's side of the family. And here the second way Aristotle distinguishes in which the catamenia can affect the semen and its operations comes into play. Since any agent in acting on materials is itself reciprocally affected by them, the semen can be brought, in working on the catamenia, to be affected by them in such a way that its movements slacken, from being ones that would produce a resemblance to the mother to being ones that produce a resemblance to her mother or another of her ancestors. The catamenia do this when their own movements (1) slacken into movements of the forebear in question; that alters the character of the catamenia as they reciprocally affect the semen, so that they induce its movements to slacken in just the way required. That is to say that one gets here a combination of both the two processes Aristotle postulates. The semen first fails to master the female fluid, which therefore departs from its nature and is made to resemble not the father (as would be more natural) but the mother. But secondly (and this is where movements in the female fluid enter the theory explicitly) the movements of the female fluid themselves slacken, reciprocally affecting the semen as it acts on it, so that its potentiality to produce in the embryo movements for the mother's ancestors (instead for the mother herself) comes into play.

Now the sentence at 768a11-14 is the only explicit indication in his text that Aristotle postulated movements somehow potentially present in a male's fluid capable of imposing on an embryo bodily resemblances to its mother's side of the family. Regrettably, he does not pause to explain how we are to understand this 'potential' presence (and how we are to relate it to the 'potential' presence of the movements for resemblances to the male's own ancestors). Two possibilities suggest themselves. If one bears in mind simply the theoretical need that

Aristotle has for such potential movements, the following, relatively vague conception may recommend itself. If there are to be resemblances to the mother or to any of her ancestors, then the embryo's own soul, through the formative movements in the blood its heart makes, must produce and maintain these. The material from which the embryo is itself originally constituted and by which it is nourished so long as it is in the womb, being provided by the mother, already carries, either actually or potentially (as an inheritance from her ancestors, through her own mother), all those movements — as movements of matter, however, not yet as formal movements (i.e. movements of the *embryo's* form). What the father's semen and its movements need to do, therefore, is selectively to elevate whichever of the movements belonging to the material provided by the mother will carry such resemblances to her side of the family as there are going to be, from being movements of matter to being formal movements *in* the matter. This suggests that we think of the potential presence of the female movements simply as the potentiality in a male's sperm to do this job: the power to work on the materials provided by the mother so as to elevate to the level of formal movements material movements already actually there (because they carried the instructions for the formation of her own bodily parts) or potentially present (as underlying traces inherited from her ancestors). On this conception, the semen would be said to have these movements potentially, just in virtue of the fact that it is capable of making the embryo have them as movements of its form — despite the fact that the semen does not impose them, in the sense of transferring from itself movements already actually or virtually existing in it, so much as simply work to strengthen movements provided by the mother in the catamenia.

On the other hand, Aristotle's mentioning together, and apparently without distinction, potential movements 'of the female and of the (male's) ancestors' may suggest some more substantial way the semen might possess these movements. For it seems reasonable to think that an animal's semen has movements for his own ancestors (in respects in which he does not himself resemble them) in some underlying, non-actual, but nonetheless physically realized way. So perhaps Aristotle is thinking that there is in the semen some physically realized representation of the movements of the females he can copulate successfully with (and their ancestors). Obviously this will still be something vague and general, since it must cover so many distinct possibilities. But on this second conception, much more readily than on the first, it will be natural to speak of a male as having in a potential way the very movements by which the mother's blood and her catamenia are actually moved (and those that are potentially in them as inheritances from her ancestors) — and, as we have seen, that is how Aristotle puts his theory at

768a14. On this second conception, he will still be saying that the semen elevates the movements of the catamenia to the level of movements of the embryo's form, but he will be postulating some sort of physically realized representation of these movements in the semen as what makes it possible for it to do this. Aristotle's text does not allow us to decide between these two ways of construing the 'potential' presence of the female movements in the semen.¹⁶ In what follows, one should bear them both equally in mind.

VI. POTENTIAL MOVEMENTS AND THEIR ACTUALIZATION

Thus, subject to clarification about how we are to conceive his own and the mother's ancestors' movements being potentially in the father's sperm in the first place, Aristotle has explained offspring, both male and female, resembling not the father or the mother, but any of his male ancestors in the male line or any of her female ancestors in the female line. Conspicuously, he has not yet explained, or even clearly allowed the possibility of, offspring of either sex resembling their father's mother or their mother's father, or any other female on the father's side or male on the mother's. I assume Aristotle intended to allow for these resemblances too, perhaps by simple extensions of his theory as so far expounded; but as I read him he does not mention such resemblances in this chapter or indicate how he would explain them.

We must take note of one last elaboration of the theory. So far I have spoken only of an offspring's inherited resemblance as a whole and overall to some single one of its forebears. But, as of course their nature as residues derived from nutritive blood already implies, both the male and the female seminal fluids contain movements specific for each of the bodily tissues and organs, and specific for them with whatever special features of form and structure the parents' blood was so 'programmed' to produce and maintain in them. (Obviously, though Aristotle does not say this explicitly, what are in question here are features of the movements (1).) So similarly for the potential movements in the fluids that, when the actual movements slacken, take over

(16) Since it says less about what in or about the semen enables it to do the required work, the first conception may seem less satisfactory than the second. On the other hand, it may be a virtue of the first conception that its commitments here are less substantial. At any rate, one might feel some discomfort with the second conception's idea that the semen has some sort, however general, of physically realized underlying movements *for* resemblances to any of the potential mothers' families. If that is the alternative, then perhaps the more non-committal first conception is philosophically and scientifically preferable after all.

and in the way I have explained, produce resemblances in the offspring to the parents' parents and grandparents: potentially, movements specific for each of the tissues and organs of each of these forebears are also present in the seminal fluids. Accordingly (768b1-5) Aristotle can claim that his theory provides an easy explanation for all possible combinations of partial resemblances between offspring and either or both parents and any of these ancestors you like. Mastery and being mastered, and slackening of movements, can be partial and selective at every level.

Aristotle will not, of course, have given a complete explanation of these or any of the other phenomena of inheritance until he has said (i) what it is for a seminal fluid to have movements potentially and (ii) how the male's sperm, in particular, comes to have the movements potentially that Aristotle says it has. The answer to this second question will be particularly difficult, of course, for the movements of the female with whom the male happens at the moment to be copulating. For, as I have pointed out, Aristotle claims the male's sperm has in some sort of potential way the movements (1) of any female with whom it mates successfully. How does an animal's sperm come to have *those* movements, even potentially?

The answer to my first question is quite easy. What it is for a seminal fluid to have some movement *potentially* is for it to have that movement in such a way that an offspring it generates, or that is generated from it, comes as a result of the generative activity, to have it *actually* in the blood that its heart makes. Or, to put the same point one stage further back in the process of explanation, it is to have those movements in such a way that the activity of generation makes the movements in the offspring's body that depend on and express its form be in actuality the same as those merely potential movements in the seminal fluids. Aristotle obviously cannot think that under certain conditions the seminal fluid of an animal, while remaining that seminal fluid, comes itself actually to be moved by the movements specific for its parents' or grandparents' tissues and organs in those respects where the animal's own tissues and organs are significantly different. An animal's seminal fluid can only actually have whatever movements were actual in its nutritive blood, and these, *ex hypothesi*, were not actual there. The actualization of these potentialities of movement cannot then be found in the semen or the catamenia themselves. But since the whole natural purpose of seminal fluid is to be the instrument or the material for reproduction, it seems acceptable to think of the realization of the potentials in those fluids as taking place outside them, in the offspring that comes into being. Anyhow, that is what Aristotle clearly intends.

For our inquiry this fact has particularly significant implications in the case of the male fluid. The female fluid has potentially the

movements of her ancestors just as the male's does of his. But on Aristotle's theory the male fluid is the *sole* source, in the sense of the moving cause, of the offspring's form and so of the movements in its body (in its heart, in the first instance, and derivatively from that in the blood that its heart manufactures) that express that form and convey it to its material constitution. When, therefore, Aristotle says that the male's sperm contains potentially both all the movements of its male forebears in the male line, *and* all the movements of the female it copulates with, including those of all her corresponding forebears, he is saying what he *must* say if he is to explain the phenomena about inherited characteristics while sticking to his basic theory of reproduction, as he has worked that out in *GA* I and II. If the offspring's metabolism regulates it in such a way as to fashion and maintain certain specific shapes and organizations for its tissues and organs, these must be due to its form (unless there is some special other explanation of how this regularity is maintained). But on Aristotle's theory the male parent, and only it, causes, in the sense of being a moving, creative, shaping cause, the offspring to have just that form, whatever it turns out to be like, that it has. If some of what the offspring's form does is to make it like its mother and her family then the father's sperm, the instrument he uses to move, fashion and shape the matter so as to have that form, simply has to have, in some way or other, those movements potentially in it. Otherwise it could not engender in the offspring all the movements that express and convey the offspring's form, and so we would have to look for a separate second source of some aspects of the offspring's form. It is clear, then, that so far from abandoning or incoherently contradicting his theory of reproduction by invoking movements in the female fluid to explain some of what happens, Aristotle goes to great lengths in *GA* IV, 3 to maintain it. By assigning the mother's movements to the father at the level of potentiality he insists, as he thinks one must, on the male's exclusive rôle as source of the offspring's form. Accordingly, in his theory of inherited resemblances Aristotle carefully denies any formative, active, creative rôle on the part of the female in bringing this form into existence. The contribution which it might appear she makes to that form, Aristotle insists, the father makes instead.

It should now be relatively easy to answer my second question, about how the male's sperm comes to have, even potentially, all these movements, both those of its male forebears and those of the prospective offspring's mother and her female forebears. About its having his forebears' movements I can be brief. (The explanation is parallel for a female's seminal fluid having in potentiality her female forebears' movements.) These the animal simply inherits. My form and the movements which express it in me derive from my father's form and the

movements that express his in him, and his from his father, and so on backwards. There should be no difficulty, then, in seeing that all those movements may be retained in my sperm, the ones that are not there in actuality being retained in potentiality.

How the prospective mother's movements get into the sperm of the male she copulates with in whatever way they do, is another question. We can best approach it by seeing how Aristotle accounts for the realization of these supposed potentialities. He appeals here to two connected ways in which in general when agents act on materials in an effort to shape and work them up, they in their turn are or may be affected by the materials (768b15-36; cf. 766a15-16, 18-21). First (b15-25) he explains the relapsing (λύεσθαι) of the male's movements¹⁷ — into the movements of his own forebears, but also, as we have seen, into movements productive of resemblances to the mother and her forebears. This is a special case of the general phenomenon, discussed in *de Gen. et Corr.* 1, 732a24ff. to which he here (b23-4) refers, of an agent's being reciprocally affected by the patient on which it acts: 'a thing which cuts gets blunted by the thing being cut, a thing which heats gets cooled by the thing being heated, ... what pushes gets pushed in a way in return, what squeezes is squeezed back' (b16-20). These examples (especially the first) clearly suggest that Aristotle is thinking here primarily of such intermediate agents as the tools a primary agent uses to bring about his effects. And that is appropriate, since on his theory the semen is the instrument the father uses to set and shape the foetus, and it is something that sometimes happens to the semen, namely the λύσις of its movements, that he is trying to explain. Failure of mastery he explains (b25-36) as a case of an agent's being too weak or the materials being too formidable in some relevant respect for the agent to impose on them exactly what, given that it is that kind of agent, it has in it to do on suchlike materials — as for example happens with athletes in training, whose unusually large intake of food (he says, b29-33) overstrains their digestive systems' power to assimilate the nutrient and distribute it so as to maintain their normal proportions, with the resulting outsized and sometimes grotesquely misshapen musculature, etc., characteristic of athletes. Here, evidently and again appropriate-

(17) It is noteworthy that though in the first words of this paragraph Aristotle offers to explain the slackening of movements in general (and so, among others the slackening of the movements in the catamenia mentioned at 768a18-21) in fact he goes on to discuss only the slackening of the movements in the semen — these are the only movements that are active, ποιῶντα of anything. This confirms the secondary rôle assigned in his theory to movements in the catamenia. It also fits in well with the attribution to the semen of potential movements somehow corresponding to them: in effect, in discussing only the slackening of the semen's movements he will have covered the whole range of the phenomena.

ly, the semen's agency is being compared, if to that of a tool at all, at any rate to one (unlike, say, a doctor's knife) with its own inherent power to affect and shape the product.

Now for each of these general principles, but especially for the first, there are difficulties in understanding how Aristotle thinks its application to the semen produces the desired results. The reciprocal blunting of a knife and cooling of a hot object placed into contact with something colder than it are instances of an agent's undergoing the precisely opposite effect to what it does (both normally and in the given case) to the patient. But in λύσις the semen is affected by the catamenia so that what it then does to them is *different* from what Aristotle thinks should be normal, and moreover it is not easy to see how the change it undergoes (from exercising its actual to exercising one or more of its potential movements) can be construed as due to its undergoing the opposite of what it does (either normally or in the actual case) to the catamenia. According to Aristotle's account there is 'going over to the opposite' in connection, not with the semen's λύσις, but with its being defeated by the catamenia. It appears that in these analogies Aristotle has somewhat run together his two processes of the defeat of the semen's movements by the catamenia and their slackening.

Perhaps the following analogy, a close relative of those Aristotle actually invokes, will help to resolve these difficulties, and to show why it seems to Aristotle to make good sense to attribute to the semen as potential movements the 'movements of the female'.¹⁸ Consider a sculptor working on some soft stone. It turns out that his skills are not adequate to make this particular piece of stone have exactly the degree of surface finish that the statuary's art demands: he does not possess the lightness of touch necessary to achieve a greater degree of finish without chipping the stone. He might of course abandon the effort once the inadequacy of his skills becomes clear to him. But suppose he doesn't. Then whatever features of shape, surface texture, etc., the resulting statue has will have been the product of *his* art: his art will have been the originating source, and the only originating source, of these outcomes (assuming nothing pushes his hand or falls on the statue while he is working on it that affects these features). The stone itself

(18) One should not object to this analogy on the ground that it compares the semen, which Aristotle treats as merely a tool used by the father (the actual 'artisan'), to an artisan (the sculptor) rather than to his tools (chisel etc.). For as I have pointed out Aristotle is evidently thinking of the semen as a highly refined, fully programmed and self-starting tool not controlled by the father himself once it is set loose, and so much more like the sculptor himself than his chisel (which is presumably why he refers to the movements in the semen as themselves δημιουργοῦσαι 768a16). It should also be borne in mind that Aristotle's doctrine in *Gen. et Corr.* 1, 7 apparently includes reciprocal effects not just on the doctor's or the sculptor's tools, but also on these practitioners themselves: 324b3-13.

contributes only as matter, not as a source of any of the changes it undergoes while these outcomes are being achieved. It is not as if there is a *nisus* in the stone for this kind of surface texture, etc. Yet the principles of the artisan's art, as they actually exist in him in whatever way principles of art do exist actually in an artisan, do not themselves explain these deviant features of the outcome. Still, even these features are not due, even in part, to any accident: the agent is the non-accidental moving cause of them, just as much as he is of the others. He at least settles for these outcomes, even though he does not set out to achieve them or intend them; on the contrary, he is aiming at as perfect a realization of the sculptor's art as he can achieve, not this defective one that he actually achieves. The skill within him is, however, such that this is the best that in these circumstances it is capable of producing. So we are led to recognize, in addition to the actual principles of the art in him, other somehow underlying and potential ones that suit him, precisely, to be the moving cause of these deviant features. What calls these 'potential' principles into play are defects in the agent's manual abilities or resistance in the materials, or both.

The father's sperm as moving cause of the offspring's form is a parallel case. Here too we find that sometimes, through no accidental interference of another moving cause, the materials do not come to have the movements that the principles for constructing it that are actually present in the sperm dictate. It comes to have female movements and/or movements that make it like its mother, or her family. Yet it was nonetheless the sperm and not the materials themselves that put those movements there: there is no independent source of development to that end in the materials. The female seminal fluids are materials only; they make no motion toward coming alive unless and until they are moved about by the sperm. So, just as in the case of the statuary, we are justified in attributing to the sperm, somehow in potentiality, exactly those movements that *would* directly explain the presence of the same movements in the offspring.

This is obviously a very weak way of having movements or other principles potentially, on either of the two ways I have suggested we might construe this potential presence. And that is all to the good. One would not want it to turn out in any more robust sense that a male's sperm has in potentiality the movements in it of the females it happens to copulate successfully with. Still, the analogy with other artisans does support this weak way of having movements potentially, and that is what Aristotle needs in order to explain this part of the phenomena. For one must bear clearly in mind that though movements specific for a female, etc. are already present in the mother's seminal fluid, they are not present in the way they must come to be

present in the offspring if it is to be a female and/or resemble the mother or her family. For the latter, they must be present as movements of *the form*; they must be movements deriving from its soul, not from its matter. And, on Aristotle's theory, only a form can make *such* movements come to be. Aristotle's claim is this: *because* those movements are present as movements of the matter, the male's form in certain cases being reciprocally affected by them, produces the formal movements in the offspring that correspond to those movements in the matter and that make its body continue to have them after it becomes a self-regulating embryo. The formal movements imposed by the sperm enable the embryo itself to take over from its mother the capacity to maintain the existence of these movements in its material constitution.

Perhaps it is not going too far to suggest that this is Aristotle's intended explanation for how the male's sperm must have potentialities in it for a female birth and/or an offspring resembling the mother or her family, and how they get realized.

VII. METAPHYSICAL CONSEQUENCES AND PROBLEMS

It is clear from our study of *GA* iv, 1 and 3 that Aristotle holds a male animal's form directly responsible for details of its offspring's internal structure and organization that lie well below the level of its specific identity as a member of the lowest animal kind to which it belongs. In his discussion there Aristotle does not say *which* such details he thinks the form is responsible for. Presumably that is because his purpose is simply to show that and how his theory of reproduction is able to handle the kinds of births that are actually observed: both male and female, and males and females that resemble, both as a whole and/or with respect to various single bodily parts, one or more of their parents, parents' parents, etc. One may however appeal to other parts of the treatise to obtain light on this question. Aristotle pursues the general topic of resemblances of offspring to parents at some length in discussing the *panspermia* theory in i, 17ff. — the theory held by some of his predecessors that the generative fluid is drawn from all parts of the body (and from both parents). At several places he mentions detailed types of resemblance, where he might be thought to be accepting that these are inherited through characteristics of the generative fluids. And in v, 1-4, he discusses, among other things, the causes of differences among human beings in eye-colour, the tendency to go grey or get bald as age advances, and the colour and texture of the hair — all differences that *we* would count as at least partly genetic in origin. Does Aristotle, too, explain them as due to inheritance?

Aristotle cites four pieces of evidence (i, 17.721b12ff.) as allegedly supporting the *panspermia* theory. The most important of these

derives from the resemblances that offspring show to their parents (b20-4). But it must be carefully borne in mind in assessing this alleged evidence and Aristotle's response to it that, as Aristotle understands his opponents' argument, the resemblances in question are of two kinds.¹⁹ First (see I, 18.723b3-9), there are resemblances that any member of the species shows to any other (of the same sex): the same organs and limbs distributed in the same manner and with more or less the same physical constitution (human flesh, hair and toenails, say, as against canine). And secondly there are more specific resemblances in any of these respects to one or another of the parents in particular. Aristotle's *panspermia*-opponents think that resemblances of both types require to be explained by the supposition that, in general, each part of the body of each parent supplies some of the generative fluid from which the offspring derives. They find confirmation for their view in the alleged fact that mutilated parents produce offspring missing the same part (721b17-20) and that children resemble their parents even in acquired characteristics, such as brandmarks on the father's arm that turn up also on the son's (b29-34).

Aristotle rejects this theory, of course, and he plainly does not feel obligated to accept that all the resemblances appealed to by its proponents (that brand-mark, for example) have to be explained at all as due to features of the semen (let alone by the hypothesis that some of it comes from each part of the parent's body). For example, Aristotle himself denies that children with congenitally missing limbs, whether they share the mutilation with a parent or not, ever lack these limbs because of defects in the semen that fashioned them (IV, 4.772b35-773a3; cf. I, 18.724a3-7). But equally plainly he does accept that many of the resemblances his opponents had in mind are inherited, and will accordingly have to be explained as passed on from parent to child through the action of the semen: it's just that the *panspermia* theory is not the right explanation of how this happens. Unfortunately, however, it is not possible to infer anything from his discussion of this theory that helps answer our question about the extent of such resemblances.

To be sure, he says clearly that resemblances between child and parent are found in anhomoeomerous parts such as face, hands and feet more than in the homoeomerous ones (tissues, etc.) (722a19-21), but this does not tell us which features of which of these parts he thinks are inheritable (for example, whether eye-colour is). Again, he objects that

children resemble parents in many respects that his opponents will have to agree cannot be due to some of the semen's having been drawn from a corresponding part of the parent: voice, nails, hair, manner of movement, grey hair or beard (when the parent did not yet have these at the time of conception) (722a5-7) — indeed, he points out (723b30-2), a son who resembles his father tends to wear shoes that resemble his too. Given the variety of items in this list, and the nature of Aristotle's argument here, it would be hazardous to infer from these passages that he accepts even the resemblance in nails and hair between child and parents as explainable by inheritance. If one were nonetheless inclined to think he did mean to be granting his opponents that point (while denying that it could be due to some of the sperm being drawn from the parent's nails and hair), the possibility would remain open that he was granting only the general resemblance (human hair and nails, as against canine) and not a more particular resemblance to special features of the parent's nails and hair. And greyness in old age he definitely does not explain as inherited, in the sense of specifically provided for in the formative movements of the father's semen and/or the corresponding movements of the menstrual fluid; it is a side-effect of the natural deterioration in the ageing process (see *GA* v, 4).

David Balme has, however, attributed to Aristotle the view that 'in a correct reproduction the offspring will be a replica of the sire', including even in non-essential details, such as eye-colour, type and colour of the hair, and so on.²⁰ Balme seems to have been led to this interpretation by reflection on the significance of the priority for Aristotle of what I have been calling the movements (1) of the semen at *GA* iv, 3.767b26-35. Aristotle does indeed say there that the movements the semen has from the father as that individual, rather than as a male or a human being, come first and will control the formation of the offspring if nothing untoward happens. But Aristotle characterizes these movements not simply as movements of the individual father (in general) but of him *καθὸ γεννητικόν* (b28), 'insofar as he is a procreator'. In explaining this qualification he excludes from the scope of the movements 'what he is incidentally, e.g. if the male parent knows his letters or is someone's neighbour'. Obviously he intends to exclude also even any congenital properties that may be similarly incidental, e.g. if by some mishap in the womb the father were born with one leg shorter than the other. The semen only aims to reproduce in the offspring whatever properties of the father are relevant to his rôle as procreator, and while it is clear that this includes all his essential organs and limbs, and all their properties (even the individual ones) that are relevant to

(19) In the Hippocratic treatise *On Generation* I can find no clear reference to the first type of resemblance. All the emphasis, at any rate, is on ways the offspring takes after one or the other parent in features distinctive of and more or less special to that parent. See sects. 8 and 9.

(20) Balme (1984), reprinted in Gotthelf and Lennox (1987) 292.

their correct functioning, there is a significant further question as to what these properties are. In general it is clear what Aristotle's answer is: whichever properties of the father's body the formative movements in his blood contain *specific information* for. What lies outside that, so that its presence in his body is, from this point of view, produced by the movements in the blood only incidentally or accidentally, it is not part of his procreator's rôle to pass on. This distinction, however it is worked out in detail, will determine, on Aristotle's view, in what respects the semen will see to it that the offspring resembles the father, and in what it may very well not resemble him, (even) if nothing untoward happens. A *replica* it certainly does not attempt to produce.

Does Aristotle, however, think eye-colour and the like are matters that the father's semen contains specific information for, and with respect to which it will cause a paternal resemblance in the offspring, if nothing untoward happens? If one consults Aristotle's discussion in *GA* v one can see that the answer is definitely in the negative. His explanation of eye-colour (v, 1.779a34-b1, b12-34), for example, is that it depends upon the amount of fluid that the eye happens to contain: people with more fluid in the eye than is ideal for seeing are dark-eyed (because large volumes of fluid are dark), those with less fluid than is ideal are blue-eyed (for the corresponding reason), those with just the right amount of fluid have eyes intermediate in colour. The quantity of any person's eye-liquid Aristotle treats as in effect an accident, the result of the amount of liquid that happened to be available for the semen when as moving cause it worked on that liquid to form the eye in the first place (778a35ff.).²¹ Likewise (v, 3) he explains differences in the condition of the hair, and hairiness itself, as due partly to accidental differences in the character of the skin and the amount and quality of the bodily fluids, and partly to environment: he explains the Scythians' and the Thracians' straight hair by the wateriness both of their constitution and of their climate, and the Ethiopians' curly hair by the dryness of both their brains and their climate (782b33-783a1).

It does not occur to him to explain any of these differences in constitution (not even these racial ones) by inheritance. Neither in connection with eye-colour nor with the hair does he anywhere employ the apparatus of mastery and being mastered and the slackening of movements that he has developed in book iv to explain characteristics

(21) I mean only to be reporting Aristotle's view, not defending it. Since for most individual animals for most of their life-spans eye-colour remains the same, through growth, etc., it must continue to be true that the combination of the auxetic movements in the animal's blood and the availability of material for adding to and maintaining the eye has the effect of preserving this colour. It is not clear that he has a good explanation for why this happens, if the form is not aiming at this result.

inherited whether from the mother and her family or from the father and his. A sensitive reading of *GA* v shows, therefore, that Aristotle thinks the father's semen contains specific instructions for the formation in the child of an eye of the right type for human vision, but that what colour it will be is determined by accidental features of the matter that the mother happens to provide for its formation on the occasion of the conception.

It follows that Aristotle does not think that the male parent's form is responsible for biologically superficial characteristics like eye-colour, pitch of voice, and coarseness or fineness, length, quantity and natural straightness or curliness of the hair. These are material by-products, not anything the form's 'programme' contains a specification for. In our example from statuary they correspond to features that a statue has because the material it was made out of already had them too. These are accidents, not initially due to the parent's form and so not later on due to the offspring's own form, except incidentally, when that takes over from the parent responsibility for its growth and self-maintenance.

Taken altogether, then, Aristotle's various discussions of inherited resemblances between offspring and parents imply a less than fully determinate theory about what features of any animal its form is directly responsible for. Its form is not directly, but only incidentally, responsible for secondary, superficial, biologically insignificant characteristics, such as eye-colour. But it is directly responsible not only for its having all the tissues, organs and limbs essential to a human being, but also for many individual features of the way these are found constituted and arranged in that particular animal. Roughly, these will be all those features that, as Aristotle thinks, cannot successfully be explained as due either to environmental influences or to incidental properties of the matter that goes to constitute and sustain them. The indeterminacy derives from the fact that Aristotle does not, and given the very incomplete information that research into animals had yet provided, presumably could not responsibly, draw this line at all sharply. But even with this limited degree of determinacy Aristotle's conception of animal forms in the *GA* has clear and significant consequences for his metaphysical theory of substantial form.

As I mentioned at the outset, some have thought from reading just the *Metaphysics* that an Aristotelian form is a non-repeatable instance of some general specific type, differing from other instances not internally (by reference to the *logos* of its being) but only by the accidental historical facts about the individual object whose form it is by which we mark that individual off from others of the same species. The *GA* makes it clear that, on the contrary, each form has in principle a full *logos* of its being as the form that it is that includes the specification of all those distinctive characteristics of structure and organization for which in the individual whose form it is it is directly responsible. In

fact, *those* characteristics are not accidents at all, but precisely programmed for in the *logos* of the movements that the form imparts to the nutritive and auxetic blood from which the organs are originally formed and thereafter maintained. Thus Aristotelian forms are particular in that each form contains within itself the basis for its differentiation from (as well, of course, as its affiliation with) other forms of the same specific type. As Aristotle's theory of the different movements in the seminal fluids makes clear, the *logos* of the being of any form (say mine) when fully spelled out will contain a good deal of information (whatever is necessary and sufficient to determine that I am a human being) that is also contained in yours. But there will also be further information that determines those special ways I am a human being which mark me off from at least most other people by making me resemble my family and not theirs. Whether or not Aristotle thought these details sufficient in principle to describe me uniquely is unclear from anything he says or implies in the *GA*. But presumably he did not.

Two immediate consequences deserve emphasis. First, in the *GA* Aristotle makes no use of and has no need at all for those species-forms — the form of a human being in general, for example, shared by all the human beings — that are the staple of much contemporary discussion of Aristotle's metaphysics. All the work such forms might be thought to do is already done by these more particular forms: my form makes me a human being, while also making me a human being with those particular further characteristics I inherited from my ancestors. But secondly, while such commitment to the detailed particularity of forms may seem to belong to the same movement of thought which, in the *Metaphysics*, at least pulls Aristotle toward a theory of forms as individual entities, one for each distinct individual substance, Aristotle's clear commitments in the *GA* do not extend that far. The decision whether Aristotelian forms are individual entities or in effect some sort of universals will have to be made on other grounds. But if they are universals they are universals of a much lower order of generality than has been thought; and if they are individuals they are individuals differentiated from one another not only by accidental historical facts about the material object whose form they are but, much more fundamentally, by the internal character of each individual form itself.²²

(22) In revising this paper for publication I have been aided by comments of Myles Burnyeat, Nicholas Denyer, Geoffrey Lloyd, and Robert Wardy when it was read to the Cambridge Philological Society. I have been greatly helped also by further written comments of Prof. Lloyd and by his paper 'Aristotle's zoology and his metaphysics: the *status quaestionis*'. Finally, sharp questioning by Jonathan Barnes, David Charles and Lindsay Judson when I read the paper at Balliol in May 1988 led to significant improvements in sections V and VI.

SPECIFIC AND INDIVIDUAL FORM IN ARISTOTLE

MONTGOMERY FURTH

In what follows I wish to discuss the issue whether according to Aristotle each individual material substance (which in practice means each individual living thing¹) has an individual form of its own, over and above the specific form that it shares with the other members of its species.

Much recent discussion has either argued or simply assumed the affirmative, i.e. that Aristotle holds the individual-forms view. My own belief is that the standard outlook in both the metaphysical and biological treatises is the specific-forms view, but that there are significant ambivalences, especially in the work on the *Generation of Animals* — ambivalences whose origin, I think, lies in an insufficiently worked-out formulation of a very basic question about heredity. The philosophical and scientific issues are closely intertwined here, and are of contemporary as well as historical interest.²

I. GROUNDWORK

I begin by making explicit several assumptions, which will underlie my treatment without being argued. They may or may not be controversial, but in either case it is important that they be explicit.

(1) In what follows, the population of substances is always understood as exclusively natural substances, i.e. animals and plants, and as not including artefacts. Despite this, of course, artefacts can still be employed to illustrate various aspects of the form-matter-composite relationship, as is Aristotle's practice.

(2) My treatment is adapted from my book *Substance, Form and Psyche: An Aristotelian Metaphysics*, Cambridge University Press 1988. Henceforth cited as *SFP*; I have not tried to expunge all references (of the form §N) to portions not included here.

(1) First, I should like to assume here that in both the biological and the metaphysical contexts, when Aristotle talks of *eidos* or *form* as a kind of *cause* of the being that is an individual material substance, the "causal" idiom is seriously and literally meant. That is, for every individual material substance, there is something that Aristotle calls "the substance of" it, which is a particular sort of causal agency that is responsible for the being of that individual substance. (Of course, I am not assuming that "the substance of" an individual substance is *exclusive* or *peculiar* to that individual substance; that issue is the one I wish to discuss.) It is not the only cause involved, to be sure, but it also is not reducible or explainable away; i.e. (I am assuming) in Aristotle's view, it is metaphysically impossible that there should be any individual material substances if there were not such a causal agency as that which he calls "the substance of" them. — The question of *Metaphysics* Zeta, "What is substance?" is about substance in this causal mode, and the eventual answer of Zeta 17, that "the substance of" something is the form of it (i.e. the *eidos*), is cast explicitly in these terms: "So the cause is being sought (and this is the form) of the matter's being some [definite] thing [*ti*]; and this [= cause] is the substance" (1041b7-9).

Aristotle regularly insists that this formative cause, i.e. form, must be conceptually distinguished from another sort of formative cause, namely the motions (and whatever other processes may be involved) that physically shape the material: the effect of the motions (etc.) is to *impart* the form, and in that sense they are involved in the *coming-to-be* of an individual substance; but it is the form imparted by the motions, and not the motions as such, that is causally involved in the *being* of the individual substance.³

The forms of natural individual substances are knowable by us, but such forms are complex and require prolonged and careful study (which is called "natural science"). The complete formula articulating the entire nature of such a form would be the form's "definition", and that which is articulated by a definition of anything is called the "essence" (the *ti ên einai*). Of course, in any proper definition, the definiendum

(3) Note the strong affiliation of this Aristotelian idea of form as a kind of cause with the flamboyant Platonic announcement of "forms as causes" in *Phaedo* 96-102 — a provenance that as far as I know Aristotle never acknowledges. It is especially pronounced in his polemic against Empedocles' elements-and-mixtures account of the nature and origin of living things (references to PA 1.1, 1.5, 2.2, DA 1.4, 2.4, Meta A.10, GA 1.18, 2.1, Phys 2.8, Cael 3.2). Both Aristotle's and Plato's *Phaedo* criticisms operate in the framework of a broad contrast between moving/material "causes" on one hand and formal/final ones on the other; and for both, the two are related as "the real cause" (here, form) and "that without which the real cause couldn't cause" (here, matter) [cf. *Phaedo* 99b, and *SFP* §19(ii)].

and definiens must pick out *the same* nature in the strongest possible sense of "same" (this notwithstanding the fact that obtaining the definition requires pursuit of natural science, and that it will certainly include matters not immediately obvious). It follows that for substances, form and essence are identical, the same thing under two different titles. (The only important complication here is that essence, unlike form, also has application to nonsubstances, since nonsubstances can also have definitions.) An immediate consequence is that since form is for substance the same as essence, the question of individual forms is the same as the question of individual essences.

That, then, is the first, large, unargued assumption: that Aristotelian substantial *eidê* are real, complex, knowable, definable (hence essences) and causal.

(2) Second, I also wish to assume here without argument that according to Aristotle an individual substance and the form that is substance of it are two distinct beings, and that the matter out of which the individual is formed by that form is a third. That is, I believe it is a serious mistake in Aristotelian metaphysics to identify the form with the formed thing (and likewise to identify the lack, *sterêsis*, with the unformed thing), as is done in some influential recent discussions.⁴ To do this both undermines the 'central dogma' of Assumption (1), that form is a *cause* of the being that is the formed thing; it also goes against Aristotle's claim that the form does not come-to-be, and must always pre-exist (Zeta 7, 8), which will figure again in Part II of our discussion. The form is form of the formed thing, the lack is lack of form of the unformed thing (normally, the matter).

A crude schematic for the relationships among these three sorts of 'being', Form, Matter, and Individual (or Composite) is this:

$$\left(\frac{F}{M} \right) = I \text{ (or C)}$$

That is a picture of *an individual F* (for example, for $F = \text{Horse}$, of *an individual horse*). According to Assumption (2), the I (or the C), i.e. the horse, is a being distinct from the F, Horse, although the F is determinative of the I in fundamentally important ways (the F is after all the "substance of" the I⁵), and it is of course standard Aristotelian doctrine that the F has no way of existing apart from (*khôris*) I's that it is substance of.⁶

(4) Reference Charlton on *Physics* i 7; Hartman; *al.*

(5) In the terms of the *Categories*, the I "is called synonymously after" the F. Hence it is by synonymy (not homonymy) that the expression "the F" can stand in for both "the horse" and "the form, Horse".

(6) Here leaving aside (a) complications about the manner in which form is carried by the seminal generative residue in procreation, and (b) the issue for below, whether the form F is the form only of a single I whose individual form it is.

It is part of this assumption that the $F \rightarrow M$ and $F \rightarrow I$ relations are very different: both the matter and the individual may be said in English to "have" the form, but the matter "has" it by being informed by it, whereas the individual "has" it by exemplifying or exhibiting it. Conversely, the form *informs* the matter, and thus comes to *be form* of the individual, two relational configurations that need to be carefully kept distinct.

Thus on top of being real, complex, knowable, definable (hence essences) and causal, Aristotelian substantial *eidê* are beings distinct from the individuals that they are forms of (or that they form).

It had better be clarified at once that I don't think the use of terminology like "essence of you" or "essence of Socrates" (*to soi einai*, *Sôkratei einai*) in places like Zeta 4 and 6⁷ carries any commitment to individual essences in the sense to be mooted here. The situation is very straightforward: there are two distinct beings, Man and Socrates, related by the $F \rightarrow I$ relation (not that the $F \rightarrow I$ relationship itself is altogether straightforward). There is the essence of Man, which is simply the same thing as Man, definitionally analyzed. The essence of Man therefore stands to Socrates in the same $F \rightarrow I$ relationship. From this it can be immediately seen that the expression "essence of" is ambiguous, for in "essence of Man" it is the identity relation, whereas in "essence of Socrates" it is the $F \rightarrow I$ relation [which certainly is not identity — at any rate, I certainly am assuming that it is not, Assumption (2)]. Whatever the case for individual essences in Aristotle may be, it does not eventuate from this terminology.⁸

(7) 1029b14, 1032a8.

(8) This is the rationale as I understand it for the thesis of *Metaphysics* Zeta that entities like the specific form Man are identical with their essences whereas composites like Socrates are not. The end of Zeta 6 alludes to the sophistical elenchus "whether Socrates and essence of Socrates are the same", to which the answer plainly must be No, Of Course They're Not. Note that 1032a6-10 does *not* say that the questions (1) whether the things that are primary and said in respect of themselves (*ta prôta kai kath' hauta legomena*) are the same as their essences, and (2) whether Socrates is the same as essence of Socrates, "clearly have the same answer" (Hartman 1977, p. 63). It says that they are "clearly solved by the same solution", which is entirely compatible with their having opposite answers (as it is evident to me Aristotle thinks they do).

Many otherwise viable interpretations of Aristotelian substance-theory come to grief at precisely this juncture. The main interpretive difficulty that commonly arises at this point consists in first recognizing (correctly) that according to Aristotle

(1) Man is identical with essence of Man,

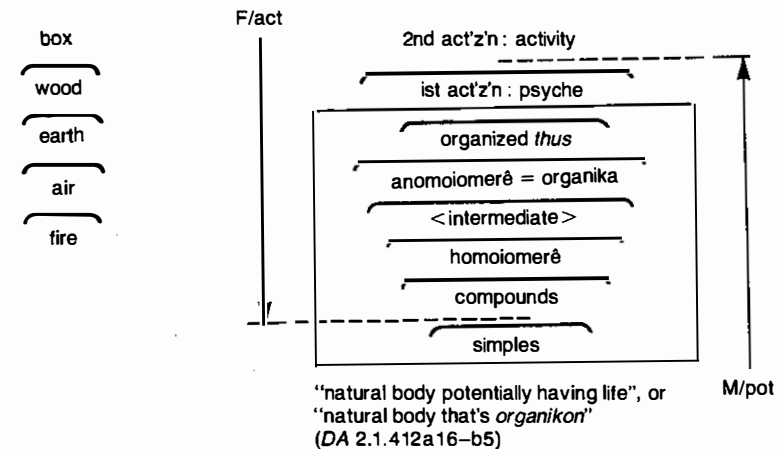
but then (not seeing the ambiguity of "of" in "essence of" — see above and the ¶ annotated) mistakenly inferring that

(2) Socrates is identical with essence of Socrates,

which does not follow from (1) and according to Aristotle (according to me) is not true (see above and the ¶ annotated). A second difficulty ensues when interpreters, seeing (correctly) that

(3) A third assumption to be used and not defended here is what I call the vertical depth and the hierarchical cumulateness of the form-matter relationship, particularly in the case of the living things, where form = psyche, and matter = the so-called "natural organic body". This vertical dimension is entirely lacking in the artefactual examples like bronze statues and spheres (which is one source of their weakness as examples); the one example of Aristotle's that is supposed to illustrate it is the somewhat ludicrous box of *Metaphysics* Theta 7 (Box out of Wood out of Earth out of Air out of Fire). But the point is crucial to the application of the form-matter structure to real substances, in which there is always a hierarchical sequence of stages, each of which underlies the next as a "matter" for an "enmattered form"; the schematic design looks like this:

Schematics of a box (*Meta*. Theta 7) and an animal (*DA*):



(3) essence of Man is identical with essence of Socrates

(but on different readings of "of" — see above and the ¶ annotated), infer from (1), (2), (3) that

(4) Socrates is identical with essence of Man and therefore with Man.

Since the same reasoning also proves that

(5) Callias is identical with essence of Man and therefore with Man, the interpretation is on the verge of reaching the result that

(6) Callias is identical with Socrates.

But (6) is absurd, and the interpretation is in bad trouble. Consequently, it is at this point that interpreters have recourse to those mushy senses of "is identical with", such that Socrates and Callias can both "be identical with" essence of Man without being identical with each other, which have so plagued the tradition, or alternatively (but it is of no help here) to an individual essence of Socrates such that (3) is false. If only Aristotle had *written out* the "obvious solution" to the sophistical elenchus at Zeta 6 1032⁶-10! It would only have taken a sentence.

In the animal, as in the fanciful Theta 7 image of the box, there is a range of intermediate locations, between the prime matter at the bottom and the final differentiation or actualization at the top, at which a matter/form division occurs, where precision calls for specifying just what fills the role of matter *at each point*, which will always be something double in its nature (*dillon*, CTB/G.C. i 5 321b20), both matter for what's above it, and form for what's beneath. (I have suggested elsewhere, dangerously perhaps, that the distinction between "perceptible and intelligible matter" (*hulê aisthêtê* and *noêtê*) may find a place at this juncture⁹).

Thus on top of being real, complex, knowable, definable (hence essences) and causal, and beings distinct from the individuals that they are forms of (or that they form), Aristotelian substantial *eidê* are vertically hierarchical and do their forming in what can be seen as ontological stages, each of which is both form with respect to what precedes in the hierarchy and matter with respect to what follows. This aspect of substantial *eidos* is not much in evidence in the *Metaphysics* (except for Theta 7), but is highly vivid and prominent in the biological treatises.

I have tried to frame these large assumptions about Aristotelian form in such a way as not to pre-judge the question of form as specific versus form as individual, although I have not completely succeeded and it should not be hard to divine from them what my leaning on the question is. Let us now turn to that question — bearing in mind, however, that rather than take a hard scholastic line on one side or the other, I am going to argue that the most interesting indications of Aristotle's attitude on the issue are deeply ambivalent.

II. *EIDOS* AS SPECIFIC *EIDOS*

Some reasons for believing that Aristotle standardly thinks of form, *eidos*, as specific form are the following.¹⁰

In the *Categories*, despite the absence from that work of Aristotle's theoretical concept of *matter*, nonetheless there are many distinct substantial individuals sharing the identical specific *eidos*: it is clear that there is contemplated no narrower *eidos* than the likes of Man and

Horse, "the secondary substances, in which as species [*eidesin*, pl.] those things primarily called substances are contained" (2a14).

(In fact, not only is there no sign of a unique *eidos* for each substantial individual of the *Categories*, but in fact in the theory of that work, the category of substance is unique in its pluralization into multiple co-specific rock-bottom individuals, which the specific *eidos* is said-of (in the technical *Cats.* sense) — rock-bottom in the sense of non-universal individuals un-predicable of anything else. In the *non*-substantial categories, the said-of chains terminate in individuals that *do* behave like universals in the sense that they can predicatively pluralize further, *via* the inherence relation (in the technical *Cats.* sense), into the multitude of substantial individuals that are in one or another way identically qualified, quantified, or whatever.¹¹)

Secondly, in the larger and deeper universe of the works *On Nature* and the *Metaphysics*, where the picture does include the causal factor called matter, there is the repeated explanation that there is a source, an origin (*arkhê*), of the fact of the many composites' — which we shouldn't forget are, after all, called the *homoeidê* — being formed by the same form — namely, matter:¹² this reinforces the impression that standardly there *is one* specific form (of sphere, for example), realized in the many bits of matter that are variously suited to 'take' it by conditional necessity¹³ — that there *is* a fact, which the given explanation explains, a *hoti* explained by the *dioti* (in the sense of *APo* i 13 78a22).

Thirdly, form has always to pre-exist the composite (Zeta 8), which alone rather obviously implies that it cannot temporally coincide with it; the manner of its pre-existence and the details of how it comes to form a composite are elaborately spelled out, in general terms in Zeta 7-9, but with full concreteness and particularity in the *Generation of Animals*, as detailed elsewhere¹⁴, and to which we shall soon return here.

Fourthly, form itself cannot either come-to-be or pass-away, for reasons given in Zeta 8 and 15, whereas it seems that an individual form would have to do that simultaneously with the composite that it formed — though we shall go further into this aspect in the next paragraph.

These are very important fixed points, consistent with which I can see only two potential ways around for ascribing individual forms to Aristotle.

(9) "Aristotle on the Unity of Form", in J. J. Cleary, ed., *Proceedings of the Boston Area Colloquium in Ancient Philosophy*, vol. II (Lanham, MD, 1987), at pp. 256-259.

(10) The best treatment of the intricacies of this topic remains even now, I think, Rogers Albritton's "Forms of Particular Substances in Aristotle's *Metaphysics*" (*J. Phil.* 54 [1957], 699-708). It too, however, stumbles over the problem about essence of Socrates discussed in note 8.

(11) This potentially outrage-provoking heterodoxy cannot be supported here; details are in *SFP*, §5.

(12) *SFP*, §19 (ii).

(13) *SFP*, §12 (i) (ii).

(14) *SFP*, §§14-15.

(1) Aristotle might have held that the individual forms (or individual psyches, in the real case) do not come-to-be at all, but are eternal, and are just enmattered or incarnated for the lifespan of what we (on earth, so to speak) call the composite. That would go some ways to meet some of the fixed points; but would also raise the awkward question how an Aristotelian form could 'be' when it was not materially instantiated. And while some such view may be attributable to Origen, there is nowhere a legible statement of such a doctrine in Aristotle.

(2) Aristotle does say that forms *are*, or *are not*, without their ever coming-to-be or passing-away (Zeta 15 1039b24-26). By this he probably seems to most readers to mean, initially and plausibly: "the forms that *are*, like Man, *are*; and the forms that *are not*, like Goatstag, *are not*; and facts like these are eternal, can never change, since no form ever comes-to-be or passes-away." But perhaps that is not what he means: perhaps he has individual forms in mind, and is thinking as follows: "of course no form comes-to-be or passes-away, only the composite does that, but: at the moment the composite comes to be, its individual form *is* (though earlier it *was not*), and as soon as the composite passes-away, then its individual form *is not* (though earlier it *was*) — but without the individual form ever being generated or destroyed. Thus coming-to-be and passing-away are still as standardly analyzed in Zeta 7-9 and the *Physics*, in terms of the *hupokeimenon* and the lack and the form; and as Zeta 8 makes clear, the form itself doesn't do *that*. It just *is*, and before and after it *is*, it just *is not*".

Such a view would already be questionable on the "forms as cause" and "form must pre-exist" counts; but there is a more fundamental difficulty with it. Namely, I cannot say whether Aristotle means this (or better, thinks he means it); but I hope he is not trying to mean this, for this is one of those things that it is impossible to mean. *If something earlier is not, and later is, then it has come-to-be: that is what coming-to-be IS, from the very meaning of the term, on any "is" and "is not" and on any possible account of coming-to-be.* Of course there are different accounts of coming-to-be, such as the Eleatic theory that it is impossible because not-being is impossible, and Aristotle's opposing theory that it is coherent because that blank not-being that so stymies the Eleatics is analyzable, into the substrate that is the matter and the lack that is the absence of the form from the matter.¹⁵ But it makes no sense on any account to say that anything *is not*, then *is*, and then *is not*, but that it nonetheless has not come-to-be and passed-away.

(15) It makes no difference, as Ross seems to think (*AM* ii 188), whether the transition from not-being to being is instantaneous, or gradual as I take the embryology of GA to make it [*SFP*, 15 (i)]. Nor does form's coming-to-be make any better sense if it is instantaneous (*AM* *ibid.*).

Aristotle says plainly enough, I think, that form cannot come-to-be on his account of that notion, because if it did, there would have to be a substrate and a lack out of which it came-to-be, which he thinks leads to an infinite regress (thus Zeta 8 1033a31-b8). And when he states, further,

"[Substantial form], then, either must be eternal, or it must be destructible without its ever being the case that it is being destroyed, and must have come-to-be without its ever being the case it is coming to be" (*Meta* Eta 3 1043b14-16),

and alludes again to the thesis of ungenerability of form (as already argued by him in Zeta 8), I take him to be stating that form is eternal because of the nonsensicality of the alternative. At least, the alternative really being nonsensical, the principle of charity recommends this reading.

Thus this way to individual forms also does not, I think, get past the fixed points.

However, as I have said, the really interesting outgivings relating to this question are not the ones usually discussed, and are ambivalent; so let us get on to them.

III. FORM AND GENERATION: A HAZARDOUS UNCLARITY

Aristotle noticed some very important "very general facts of nature", Wittgenstein's "sehr allgemeine Naturtatsachen" (*PI* II xii), about the animal kingdom. One of them is a fact about generation (I call it Fact Five), it is that *animal offspring almost invariably share their specific character (are homogenê, or homoeidê) with a pair of parents, and vice versa*: more fully, (a) with a few explicable exceptions, the existence of an animal is *invariably* traceable to a pair of parents specifically identical with it; (b) with a few explicable exceptions, a pair of animals that generate offspring at all are *invariably* specifically identical with one another and generate offspring specifically identical with themselves. In other words, *generation is normally reproduction*: no tautology, but a whacking great *a posteriori* truth, and perhaps the most remarkable fact about nature that there is: *anthrôpos anthrôpon gennai*, man generates man, as he repeatedly reflects¹⁶, *never* horse or squirrel or ant; from which can be gathered with great probability that there must be a *copying mechanism*, highly reliable and very accurate,

(16) For references, see *SFP*, p. 74, n. 13.

guaranteeing the transmission of specific nature identical and intact from one generation to the next.¹⁷ Remarkable, to say the least.

Obviously, Fact Five is the salient phenomenon facing any embryological theory: the fact of cospecificity between forebears and offspring; any would-be such theory that does not explain this phenomenon, and in particular its virtual invariability throughout Nature, is useless from the outset. The Aristotelian embryology in *Generation of Animals* (hereafter GA) faces this problem squarely; the phenomenon is recognized and its fundamental importance understood, a number of further pertinent observations about the course of development of animal offspring over time are added to the picture, and a causal mechanism is adduced that explains the total observational given and reduces it to an intelligible pattern. Judged by our contemporary standards, for what those may be worth, the observations are for the most part remarkably accurate; the adduced causal mechanism presents a more difficult case, for it is factually almost completely wrong and yet in certain matters of fundamental principle so completely right that it is something of a wonder how it can be simultaneously both. A fuller assessment is given elsewhere.¹⁸

Now for the complication. I have just asserted that the "salient phenomenon" facing the embryology is that of the cospecificity of parents and offspring, and indeed, the evidence is that that is for the most part how Aristotle sees the problem in GA prior to iv 3. However, in interpreting the GA, one should keep in mind a deep ambivalence, much too little noted, in that work as to the *phainomenon* it is supposed to explain. That is, is it that of *species identity* between parent(s) and offspring, or is it that of offspring's *resemblance to its particular parent(s)*, the likes of Windsor chins and Hapsburg noses? The difference between these as *phainomena*, which is crucial, never gets sharply conceptualized in Aristotle's embryological discussion, an omission which has important consequences. It is my reading of the GA that the main preoccupation of the first three books in this area is with the former question, that the main features of the theory of generation are worked out in that context, and that the bringing to bear of the theory upon certain evident facts about heredity (and in particular, resemblances between offspring and female parent) in Book

(17) The recognition of this fact as the leading phenomenon to be saved by his theory of generation inclines me to think that François Jacob is mistaken in saying, "Only towards the end of the eighteenth century did the word and the concept of reproduction make their appearance to describe the formation of living organisms. Until that time living beings did not *reproduce*; they were *engendered*." (Jacob 1973, p. 18, emphasis mine.) He may well be right about the word, but not about the concept, which is explicit and emphatic in Aristotle.

(18) SFP, §§ 14-15.

iv is basically a new — and unhappily belated — concern, and not even a central one at that (it arises in connection with teratology and the explanation of the sex of the offspring). This is perhaps the most critical issue at the juncture of the biology and the metaphysics: it is the embryological side of the individual-form versus specific-form issue.

III (A). OVERVIEW OF GENERATION IN THE GA

I take it that the main lines of the official GA account are familiar. According to it, the specific form of the species is stored, in a very special way, in the semen (*sperma*) of the male parent. The female parent contributes a material mass of partially "concocted" (*pepemmenon*) "residue" (*perillōma*), more or less identified with the menstrual fluid (*kalamēnia*) of higher mammals and something analogous in other species, and also (in most cases) the place in which the fabrication of offspring is to occur. The generation of animals is then a process in which the form as stored in the semen is read into the matter as represented by the catamenia, by way of a pre-programmed sequence of mechanical and chemical operations (which are understood in a general way and for which several analogies are provided, but of which the full concrete details are not available). In the course of development the offspring-to-be passes from the condition of a relatively inchoate catamenial mass, through a series of intermediate phases as progressive differentiation takes place under the formative influence of the semen, until the final phase is reached, that of the "completion" or "end product" (*telos*): one or more fully specified miniature individuals cospecific with the parents. At the earliest stage the embryo (more accurately, the *kuēma*, "fetation" — Peck) is plantlike in its nature (an early event is its driving a "root" into the uterine wall¹⁹), but it is not yet actually, although it is potentially, an animal. Subsequently, as the parts articulate out, it becomes recognizably animal, but it is not yet actually, though it is potentially, any specific type of animal. Fully specific form is acquired last, and only then do we have *a man* or *a horse*:

For it's not simultaneously that *an animal* and *a man* come-to-be, nor *an animal* and *a horse*, and likewise in the case of the other animals (= types of animal); no: the end-product or completion (*telos*) comes-to-be last of all, and the most distinctive character (*idion*) of each thing is (comes at) the completion of its genesis. (ii 3 736b2-5)

(19) GA 2.3 736b2, 4, 739b33, 740a24. The general description given here applies most directly to the higher vertebrates (or, roughly, "blooded" animals, Aristotle's *enaima*); many variations and refinements, homologues and analogues, are described at length in both the *Generation* and the *History*.

Thus the development is one in which the original matter is successively articulated through more generic phases to more specific ones, until the final, "perfected" (*teleion*) phase is reached. The role of the semen throughout is to articulate, form, shape and set the developing animal as it passes through these phases toward fully specific form; it contributes no material part to the offspring, and influences only the offspring's form by way of its causal agency. When differentiation is complete, the semen's function is accomplished and it dissipates and disappears. In some cases considerable further *growth* of the offspring may take place after differentiation is complete; such increase in bulk occurs through the intake of further material nourishment — e.g., in the case of vivipara (who bear live young), first *in utero* by way of the placental "root" up to the time of birth, and subsequently as the offspring takes nourishment from without.

III (B). THE GENERATIVE RESIDUES

Briefly, the natures of semen and catamenia are as follows. All 'blooded' organisms (*enaima*) engage in the taking-in of nourishment (*trophê*) and the refining ('concocting', *pellein*) of it into residues (*perillômata*), various uniform organic compounds that subserve various organic processes [cf. § 11 (i)] — the whole process is one of the kind we call metabolism, and thus may be called threptic (from the adjective from *trophê*) in the broad sense of metabolic²⁰. The first stage of this process, in the alimentary tract, is digestion. The second stage, in the heart, results in the most refined of the threptic residues, namely blood; this is then pushed out through the bloodvessels to the various somatic tissues and organs which it sustains in their active 'being' and whose growth it also brings about (i.e., for which the blood is both 'threptic' and 'auxetic' in the sense of *SFP* § 16). Thus much, at this point, for metabolism. However, in the heart a small quantity of blood gets further concocted into the most refined residues of all, the 'generative residues': catamenia in the female, and semen in the male. Of these, catamenia are the more inert and passive, and semen the hotter, more kinetic and more active; and it is the particular characteristic activity of the semen, in accordance with the specific "*logos* of the movements",

(20) The activity of 'threptic psyche', and its role in the overall 'being' of the organism, is further enlarged upon in *SFP*, § 16. Strictly speaking, the threptic process (i.e., the refining of nutrients into 'useful residues') is our 'anabolism'; our 'katabolism', resulting in waste-products (Aristotelian 'useless residues') would correspond to the process he calls *suntêxis*, resulting in a *suntêgma*. At least, this is Platt's suggestion (Addenda to the Oxford tr. of GA [1.18 724b27 n.]).

that imposes the specific form of the male parent²¹ on the catamenia furnished by the female.

In discussing the mutual operations of these two *arkhai* in generation, it is useful to separate certain issues of general principle from questions relating to the particular types of causal mechanisms that Aristotle theorizes as being involved. These mechanisms, according to his account, are briefly as follows:

The semen of the male parent, as has been observed, does not itself contribute any matter or constituent or part to the developing conceptus or *kuêma*; rather (a) it is hot, being a "foam" (*aphros*) whose base is Water but whose active ingredient is pneuma (= very hot air, the "heat" being not the ordinary sort, which is that of Fire, but something more like a "vital" heat; cf. GA [Loeb], Peck's introduction, pp. lii ff. and further references); (b) the semen is active and formative in character, being pre-programmed with a variety of highly intricate "motions", which "shape" and "set" the catamenia in stages as development advances.²² Two comparisons are used to illustrate the activity of the pneuma: (1) the craftsman's tools (in this case "Nature" occupies the role of craftsman): they shape the wood, but nothing of the tools themselves remains in the finished product: "nothing passes from the carpenter into the pieces of timber, which are his material, and there is no part of the art of carpentry present in the object which is being fashioned: it is the shape and the form which pass from the carpenter, and they come into being by means of the movement in the material" (GA i 22 730b12-15, tr. Peck), and so it is with the pneuma, Nature's tool. When its "activity" is finished, the physical material of the pneuma dissipates and disappears (ii 3 737a11), still being itself no part of the offspring. (2) Another comparison is the action of rennet or figjuice in the curdling of milk: milk is the matter, rennet has got the *arkhê* that makes it coagulate and "set"; *hê puelia gala esti thermolêla zôlikên ekhon, hê to homoion eis hen agei kai sunislêsi*, "rennet is milk that has vital heat; this integrates ('works into a unity') the homogeneous stuff, and 'sets' it", ii 4 739b24. Sometimes the action of yeast is instanced along the same lines. So, too, the pneuma "sets" the *kuêma*.

(21) This is the preponderant view of the GA prior to GA iv 3. For complications and details, see III (C) below.

(22) This is the other point [the first was that of the heart's being the first thing to be formed in embryonic development] upon which Harvey could not verify Aristotle. Looking for the 'inchoate mass', he dissected does (= female deer) taken by the royal hunting-parties in King Charles I's forest preserves at various points shortly after coition in the rutting season, and "could never find in the cavity of the uterus or its horns any semen or blood or trace of any other thing" (see Harvey [1653], 351-354). Six to eight weeks after mating, he found something: "resembling a membranous and mucilaginous coat or empty wallet... this elongated little sack is spun out over the whole cavity of both horns and of the uterus between them" (355). This is since called the blastodermic vesicle (A. W. Meyer [1936], 109-117). Thereafter a recognizable fetus quickly appeared (Harvey, 359-360).

III (C). COLLAPSE OF THE OFFICIAL VIEW: GA IV 3

(1) GA iv 3 767b23-769a6 (from OCT).

767b23 I mean by "each dynamis" the following: the progenitor (*to gennôn*) isn't just male, but he's such-and-such a male, as Coriscus or Socrates; and he's not just Coriscus, but also man. And so in this way some of the things belonging to the progenitor are nearer, some remoter — according as it has the generative power (*kalho gennêlikon*), not as what he may just "happen" to be, like the male progenitor being grammatical, or someone's neighbor. b29 And what's peculiar (*idion*) and particular (*kalh' hekaslon*) exerts the stronger influence on the genesis. For Coriscus is both man and animal, but man is nearer to what's peculiar than is animal. Both the particular and the kind (*genos*) generate, but more the particular; for that's the substance. As a matter of fact, the product (*lo ginomenon*) indeed comes-to-be of-a-particular-sort (*poion ti*) — but simultaneously²³ also a particular this (*lode ti*) — and that's the substance. b35 For which reason it's from the dynameis of all these sorts of things that the motions in the semens are constituted — potentially indeed from (the dynameis of) the earlier ancestors, but more especially from those of the one which in each case (768a) is closer to some particular — I mean by particular, Coriscus, or Socrates.

768a2 Now, when anything *departs from type* (*exislalai*), it goes not into any chance thing but into the opposite, and so too in generation, what isn't mastered necessarily *departs from type* and comes-to-be the opposite with respect to the dynamis with respect to which the generator and mover didn't get mastery. a5 If, then, it's *qua* male, what comes-to-be is female; but if it's *qua* Coriscus, or Socrates, what comes-to-be is a likeness not of the father but of the mother; — for just as in general (*holôs*) mother is opposite to father, so the particular female-progenitor (*gennôsa*) is opposite to the particular male-progenitor (*gennôn*). And likewise with respect to the next dynameis down the list; it [= the "motion"] always shifts over (*melabainei*) more to the next in line of the ancestors, both paternal and maternal. a11 Some of the motions are present actually, others potentially: actually those of the male progenitor and of the universals such as man and animal, potentially those of the female and those of the ancestors.

(23) Reading *hama* ("simultaneously") for *alla* ("but"), after Rackham and Peck.

a14 Now (a) the thing departing from type (*exislamenon*) shifts-over toward the opposites; but (b) the fashioning ("demiurgic") motions relapse [*luonlai*, "slacken"?] into ones that are near them, e.g. should the motion of the male progenitor relapse, it shifts-over first by the minimal difference into that [i.e., the motion²⁴] of his father; [if a] second [time], into that of the grandfather; a18 and in fact in this way also among females, the [motion] of the female progenitor [shifts-over first] into that of her mother, or if not into that, into that of her grandmother; and so on up the line.²⁵

a21 Most of all what naturally occurs is that [the male motion] does its mastering and getting-mastered, *qua* male and *qua* father simultaneously: for the difference is small [between male and father?], so there's no big job in their both occurring at once; for Socrates is a particular male of such-and-such a sort (*anêr loiosde tis*). a24 This is why for the most part the males resemble the father but the females the mother, for the departure from type (*ekslasis*) has occurred towards both respectively at the same time; female is opposite of male, and the mother is opposite of the father, and the departure from type is into opposites.

a28 But if the motion from the male does get mastery but that from Socrates doesn't get mastery, or the latter does but the former doesn't, then what occurs is the coming-to-be of males resembling the mother, or females resembling the father [respectively].

a31 But if the motions relapse, then [a] if the one *qua* male stands fast but that from Socrates relapses into that of his father, then there will be a male resembling the grandfather or some one of the other earlier ancestors, according to this account; a34 [b] if it gets mastered *qua* male, then there will be a female and for the most part one resembling the mother, unless this motion relapses too and the likeness is to be to the mother's mother or another of the earlier female ancestors, by the same reasoning.

768b1 The same scheme holds for the various parts; for of the parts some will very frequently resemble the father, others again the mother, and others still various of the earlier ancestors; for the motions of the parts, too, are present some actually, others potentially — as has often been stated.

b5 But it's necessary to take hold of the *general principles* ["general hypotheses"], First: the one just stated, that some of the motions are present potentially and others actually; but in addition two more;

(24) The motion, not the type, thus Lesky 1950, p. 152, as against Wimmer.

(25) The first explicit mention of motions emanating from the female's residue; cf. Lesky 1950, p. 152, and III (c) (2) below. The received text says, "in fact in this way both among males and also among females"; Wimmer and Peck would omit the entire phrase. I follow OCT.

[Second:] that what *gels mastered* departs from type, into the opposite, but [Third:] that what relapses passes into the motion that's "next" to it: relapsing a little, into a near motion; more, into one that's farther away. b10 Finally [the motions] so run together that it doesn't resemble any of its household (*oikeia*) or kindred (*sungenê*), rather all that's left is what's common [to all], and it's [simply] man. b12 The reason for this being that this [= what's common] goes with all the particulars; for man is universal (*kalh' holou*), but *the father*, Socrates, and *the mother*, whoever she may be [!], are particulars (*kalh' hekasta*).

b15 The cause of the motions' relapsing is that what acts also gets acted upon by what's being acted upon, as what cuts gets blunted by what's being cut and what heats gets cooled by what's being heated, and generally what moves (except the first mover) gets moved by some motion in return, e.g. what pushes is pushed back in some way, and what squeezes is squeezed back; b20 — sometimes, it's even acted-upon altogether more than it acts, what heats may get cooled, or what cools get heated, sometimes not having acted at all, sometimes [having acted but] less than being acted upon. There is discussion of these matters in *Acting and Being Acted Upon*, where it's explained in what sorts of things acting and being acted-upon occur.

b25 What's acted upon *departs from type* and doesn't get mastered, either [a] owing to deficient power in what's concocting and moving, or [b] because of the bulk and coldness of what's being concocted and defined. But since it gains mastery here but fails to get mastery there, it makes what's being composited (*lo sunislamenon*) turn out diversiform (*polumorphon*) — the way it happens with athletes through eating too much (*poluphagian*) b30...

769a1 The cause of all the following has now been explained:

[1] Why males and females [offspring] comes-to-be;

[2] Why some resemble their parents,

[a] females [offspring] resembling females [parents], and males resembling males,

or, conversely,

[b] females resembling the father, and males the mother;

and, in general,

[3] Why some resemble their forebears, and others resemble none of them; — all of this with respect to the whole body, and with respect to each of its parts. a6

(2) The underlying and interesting source of the Sexism.

In the section of the GA just quoted, in which the official theory of generation as developed earlier in the work is for the first time confronted with some fairly apparent facts about heredity — particularly, resemblance between offspring and female parent — the evident result is, if not a rout, something of a disorderly retreat; nothing (or next

to nothing) has been heard earlier of "motions" actively occurring in or coming from the female material in its own right, and the constantly reiterated theme, that it is only the semen of the male that has the *arkhê kineseôs* and that the female's contribution is *hulê monon*, has been last repeated only a page before the confrontation and consequent rout/retreat begins (766b12-14). And beyond its inconsistency with the earlier explanation, the GA iv 3 account does not make very good sense in its own right: are the female "motions" of the catamenia (as instrument), or in the catamenia (as substrate)? If the former, then *what is being worked on*? If the latter, then *what is working*? Certainly the comparison of 768b15, with hatchets getting blunted or warmers getting cooled, is not enough to support the suggestion of 768a18, that there are female motions adequate to shape the *kuêma* into a facsimile of mother or mother's mother. It is worthwhile, therefore, to look a little farther into Aristotle's account of the respective roles of the sexes in generation — what factors can they be that have caused him to cling so stubbornly to the male-motions-only view, when his own observations (not to say anyone's observations) point so plainly to its untenability and it must be unceremoniously dumped as soon as they are brought up?²⁶

(26) Such review of recent literature as I have made, which is anything but comprehensive, indicates that apparently my view of GA iv 3 as a collapse of the earlier explanation, though not unshared, is not widespread. Thus Balme (1980), p. 2, equably epitomizes:

"If the sire's movements fail to control the foetal matter, the next most effective determination comes from the female's movements which are present in the foetal matter (blood in the uterus). If they too fail, movements inherited from ancestors exert control in turn..."

The discussion of resemblance in Preus (1975), pp. 101-104, evinces no alarm on this issue. Pellegrin (1982), pp. 134-135, is not concerned with this problem (his focus is on *parekbasis* as a case of the "plasticité" of the human *genos*). Morsink (1982), calls the introduction of female movements "an important qualification of the form-matter hypothesis" (pp. 138, 141, cf. vi), and argues diligently in its defense against its critics and against sundry defenders of the un-"qualified" theory (pp. 141-143):

"The qualifications made in Book IV do not conflict with the initial hypothesis, but bring it into line with some facts that would otherwise be its downfall".

Kullmann (1979), p. 52, likewise employs the language of "modifiziert". Peck (1953), p. 17, seems to think of GA iv 3 as an 'extension' and not a contravening of the earlier account. As far as I have found, only Lesky (1950), pp. 152-154, adequately appreciates the extent of the inconsistency between iv 3 and the earlier treatment; she too is struck (p. 153) by the oddity ("merkwürdig" is her word) of its overlooking by previous accounts — though she does cite (*ibid.*) a criticism of this part of Aristotelean theory from Galen (*de sem.* IV 602 f., the following a tr. of Lesky's tr.):

...because they assert that it is the power of the sperma that develops and forms the germ, but a little later forget about this and quite fail to notice that they ascribe exactly the same powers (or even more) to the material, that they

Charges of inconsistency and incoherence are a serious matter, particularly as regards a theory as brilliant in so many other ways as that of the GA, as well as one that has been so thoroughly studied over the years. I shall proceed by (a) establishing the extent of the surprise that GA iv 3 presents to the reader who has assiduously taken in what comes before, and then (b) offering an explanation for Aristotle's persistence in the male-chauvinist form of account until it inevitably crashes in that chapter. For I think that besides the conjecturable social and political bases for this cast of his thought, there is a theoretical source of much greater interest. [Some readers will as soon skip the details of (a).]

(a) *The inconsistency*

(i) *Does generation transmit parental and not just specific form before GA iv 3?*

As briefly mentioned as early as § 9 and again in § 14, there is some considerable ambivalence in the GA over whether the phenomenon to be "saved" is that of offspring's resembling parents in specific form, or is resemblance in point of particular parental characters (the example was Hapsburg noses and Windsor chins; let "H-W" be acronym for this).

Certainly striking in GA iv 3 as just rendered is the claim that the male's formative contribution to generation is multifold: he generates as man and as animal, but also as Socrates and as male, in the form of seminal motions for all of these natures, both general and particular. Furthermore, the strength of the respective motions is said to be greater as the generative nature is more peculiar (*idion*) and particular (*kath' hekaston*); thus, according to this section, the most powerful contribution is that of Socrates = such-and-such a male (767b25) = the substance (767b33-35) = *lode ti* (767b34-35) = the father (implied 768a21-31, explicit 768b14-15). A lesser kinetic influence is wielded by the specific form, Man, according to this passage, and the least is that of the genus, Animal (767b29-32).

What then has been heard of H-W parental resemblances as theoretical *explanandum* earlier in GA? The answer is, not nothing, but rather little. Here is the evidence.

had previously assigned to the fabricator [Werkmeister], i.e., the formative power of the semen".

— Apart from questions of consistency with the account earlier in GA, I have not found company in regarding the iv 3 explanation as defective in internal coherence (cf. above), nor in tracing Aristotle's persistence to the last ditch in the "male motions only" theory to the theoretical difficulty of dividing the form (cf. below). It seems doubtful that the renegade remarks of Meta Zeta 7 1032a28-32, Zeta 9 1034b4-6, have much bearing on this issue.

(1) According to the opening manifesto of GA i 1, which certainly should be accorded special importance, the phenomenon involves the sexes and homo-generic generation: *things generated by the sexual union of things of the same kind are of the same kind as those things, homogenê*. This is simply the fact that "generation is, normally, reproduction", i.e., Fact 5 (above, III *init.*); it certainly is not H-W resemblance. (i 1 715a22-24, b2-16)

(2) In so stating the matter, the inquiry is leaving aside those cases of genesis (mainly of certain insects) which are "not *ex homogenôn*" because they are spontaneous, from decomposing matter (i 1 715b27), such as fleas and flies (i 16 721a8, i 18 723b4), clothes-moths from wool (iii 9 758b23), etc. Here there are no 'particular parents' to which resemblance would be an issue.

(3) In the great Scala Animalium of GA ii 1,

"Some animals work up to completion and expel into the world something like themselves; ... others engender something less articulated, which has not yet taken on its own shape, ... an egg, or a scolex" (ii 1 732a25-29)

In this scheme, which is repeatedly returned to, there can be no possible doubt that *homoion heaulôî* and its cognates means specific resemblance; the more perfect offspring, *leleôtera* (733a32 ff.), obviously are to be understood as *homogenê* or *sunônuma* in that sense, that is, as contrasted with a scolex, i.e., a pupa or grub (cf. i 16 721a2-7, i 18 723b3-9). In this context, the concept *tên oikeian morphên lambanein* (ii 1 733b20-21) has to mean "assuming the form that is specifically peculiar or unique", not a familial or paternal "form" in any more exclusive sense. It is routinely so glossed in explanations: e.g. *egennêse to sunônumon, hoion anthrôpos anhrôpon* (ii 1 735a20-21), that is, man begetting man, not Alexander begetting Alexandrovich or Alexandrovna.

(It should be noted more generally that allusions to "resemblances to the parents", *homoiotêtes pros tous gennêsantas*, are often to be cashed out in the same way, as specific, or at least are not automatically interpretable as [though they can sometimes be] likeness of particular "house and lineage", *sensu* Luke ii 4.)

(4) The discussions of results of cross-breeding (e.g. ii 4 738b27-35) are in terms of the specific types of the parents (though mostly factually wrong in this case; cf. Platt *ad loc.*); the same holds for the treatment of the mule (ii 8).

(5) That is fairly weighty on the specific-resemblance side. Contrarily, there is one section, totalling about one Bekker column, before iv 3, that *does* contemplate H-W resemblances. It is all in i 17-18, pro and contra pangenesis. (a) It is an argument for pangenesis that offspring resemble parents part for part as well as in the whole body

(i 17 721b21-24). As just pointed out, this language is not decisive of itself as to H-W resemblance, but in the surrounding context of (b) and (c) it is the likeliest reading. (b) The inheritance of acquired (*epiklēla*) and not just congenital (*sumphula*) characters ("the man from Chalcedon", i 17 721b28-34): clearly has H-W in mind. (Of course, this is later rebutted as an argument for pangenesis, i 18 722a2 ff., etc., but we are talking about the *phenomenon*.) Similarly for the inheritance of mutilations (i 17 721b17-20) (also rebutted, i 18 724a3-7). (c) Likeness to remoter as opposed to nearer ancestors (i 18 722a7-11) also seems to show H-W in mind.

From this review it seems fair to conclude that although there are indications both ways and obviously the issue has not been sharply formulated in the author's mind, the weight of the indications — especially in the globally important i 1 and ii 1 — is towards the theoretical explicandum's being the phenomenon of specific resemblance. Parental H-W resemblance mostly lies doggo, and maternal resemblance as a phenomenon is completely overlooked. In this setting the male-motions-only theory of specific resemblance is worked out in detail, and the embarrassing *dénouement* of iv 3 is the inevitable consequence.

(ii) *Are the catamenia active and kinetic before GA iv 3?*

As to the idea that there are maternal 'motions' working through her catamenial contribution to genesis, this comes in iv 3 as a total surprise.

(1) We have discussed the formation of catamenia and semen in III (B); they are "generative residues" formed in the heart, from blood, which itself is the ultimate "threptic residue" that energizes and augments the various parts of the living body. Evidently the nourishing and growth-producing power of blood is also somehow kinetic in nature — it seems that the blood that is threptic and auxetic for e.g. the liver has hepatic motions, and that destined for the kidneys has nephritic motions; and at one point the threptic/auxetic activity of blood is explicitly claimed to be somehow continuous with the eidopoietic activity of the male's semen:

Semen is a residue that is moved with the same movement that is auxetic for the body when the final *trophē* is partitioned; coming into the uterus, it constitutes and moves the female's residue with the same movement wherewith it is moved itself." (ii 3 737a18-22).

Note that this *does not* mention a 'movement' that is peculiarly paternal as against specific: the portions or 'partitions' of blood that are threptic and auxetic for kidney and hand may be taken (for all this passage has to contribute) as so for *human* kidney and *human* hand, not necessarily Socratic or Callian. On the other hand, it *does* clearly ascribe a kinetic

activity to the blood of the male, that is independent of and prior to the final refinement of that portion that becomes generative and seminal (and "comes into the uterus"). There seems to be no reason (gatherable from this passage) why the female generative residue, the catamenial, should not inherit such movements from her blood, as well — but such movements are nowhere contemplated, let alone officially recognized, until iv 3. (Where, in addition, there is still the problem of detail unclarified even there [p. 101 above]: movements *of* the catamenia, or *in* it? What is working upon what?) However, it should also be noted that the ii 3 passage quoted is dangerously confused on an important issue: the movements described are *auxetic* (growth-inducing), not *poietic* (formative), and the transition from auxetic movements in a threptic residue to poietic movements in a spermatic residue poses a serious problem to understand: if that transition is not very carefully negotiated, the "precision" of the account that we were recently admiring will collapse into the cruder version that we were contrasting with that²⁷). Furthermore, even in iv 3, the image is still being maintained of the female residue's role as that of *resistance* to "being acted upon" (768b15 ff.); this is an indication that even in iv 3, the idea of activity on the part of the female residue still is not very clearly viewed.

(2) There are two further passages that might seem to suggest particular-parental movements, narrower than specific, but on close examination do not, still less maternal movements:

(i) "The semen is a residue of the *trophē* that has become blood, that which is distributed into the parts [of the body] in its final stage. And this is the reason for its great power — for the loss of [such] pure and healthy blood is debilitating — and it is reasonable that the offspring come-to-be resembling the parents; for that which goes to the parts [of the body] resembles that which is left over." (i 19 726b9-15)

(ii) "To recapitulate: we say that the semen 'underlies', as the final residue of *trophē*. (By *final*, I mean carried to each [of the bodily parts], and this is why that which is generated resembles that which generates; — it makes no difference [to say] 'comes from each of the parts' or 'goes to each' — but the latter is more correct.)" (iv 1 766b7-12) (The passage continues, the male moves, the female supplies only matter: b12-14.)

Thus there seem to be no attributions of catamenial activity or movement in the GA prior to iv 3.

(27) § 14 fin., and note 14/27. [About precision generally in GA about the semen being "potentially" this or that, not because it is going to *become* this or that, or is an *ex hou* for this or that, but because it has the appropriate "power" of moving the materials. Contrast with various other works where a cruder picture is allowed for illustrative purposes (Ross AM i 155 on Theta 7, Furth Eek 135-136).]

(3) There are, however, a number of vague references to catamenia as 'spermatic' and 'potential', and it is possible that these may be intended as insinuating that catamenia can convey movements imposing maternal characteristics, if the seminal movements are weak.²⁸ Their weight as factors in the balance seems to me uncertain at best.

i 18 "Spermatic residues" in the uterus (but also in pudenda and breasts [?]) (725b3)

i 20 "Catamenia are semen that is not pure but in need of being worked on... [comparison with plants]... when it is mixed with semen, ... then it generates." (728a26-30)

ii 3 "Female's a mutilated male, catamenia are impure semen — catamenia lack the *arkhê psuchês* — so a wind-egg has parts of both [sexes] [potentially?]" [So Platt; what else can it mean?] (737a27-33)

ii 5 Wind-eggs have threptic psyche potentially, but can't complete the parts and the animal, without aesthetic psyche. (741a23-28)

[The association of generation and threptic psyche in some passages also goes to a quite different point, relating not to an alleged spermatic power of catamenia but the generative power of the individual specimens being a kind of threptic power in the species: see § 16 (ii).]

(b) *The interesting source of the sexism*

The model of the nature of male and female that is taken for a starting-point at the outset of the GA, as *endoxon*, is that of male = what has the *arkhê* of movement, and generates in another; female = what has the *arkhê* of matter, and generates in itself (i 2 716a5-7, 13-15); this is their "difference in *logos*", from which stem their differences in organic reproductive parts (a23 ff.). When the actual theory of sexual generation is taken up in i 17, the discussion and refutation of the pangenetic hypothesis is the main preoccupation of the next several chapters (17-21); and in the course of this, a suggestion of Empedocles' is considered as to how both the male and female parents might be thought to contribute to generation a genetically significant "semen":

Again, if [the semen] comes from all parts of *both* (parents) alike, there will come-to-be two animals; for it will have all the parts of each. Hence, if it's to be stated in this way, it seems Empedocles' view is in closest agreement with this one²⁹: for he says that *in the male and in the female there is a sort of tally [i.e., complementary halves in each adding up to a single whole], but the whole doesn't come from either one,*

"but sundered is limbs' nature, part in man's..."³⁰

(28) These, and this interpretation of them, have been suggested to me in correspondence by David Balme.

(29) Following Peck, a few words that follow are deleted; but in any case they seem to have no bearing on the present issue.

(30) Presumably this verse of Empedocles' (DK fr. 63, q.v.) continued with something like,

"...seed, and part in woman's..."

Cf. Diels-Kranz (1966), i 336; Wright (1981), 219.

For [otherwise], why don't the females generate out of themselves, that is, if [the semen] comes from the whole body and they have a receptacle? But as it seems, either it doesn't come from all the body, or else it comes in the way that that one [= Empedocles] says — not the same parts from each, and this is why intercourse between the parents is required. (i 18 722b6-17; also iv 1 764b3-20)

A modern reader can readily see that this suggestion (italicized in the quotation) is from a theoretical standpoint extremely promising: the "tally" (*sumbolon*) is, e.g., one-half of a coin or other conventional item which has been broken in two, one to be kept by each of two parties to an agreement, or their heirs or assigns, or one to be carried by a courier to validate, by matching with its complement in the possession of the recipient, the authenticity of his message.³¹ But Aristotle does not follow it up, instead criticizing weaknesses in the way it has to be developed within the Empedoclean framework:

But this is impossible too. For the parts cannot survive and be alive if 'sundered', no more than they can when they are large, in the way that Empedocles generates them in his 'time of Love':

"where many neckless heads sprang up...", and then, he says, grew together thus [as we see them]. Patently impossible! For not having soul nor some sort of life, they can't possibly 'survive', nor, if they are like several living animals, can they grow together so as to become one. Yet this is the sort of thing they have to say who say that [the semen] comes from all the body — as it went then in the earth under Love, so it must go for them in the body. For it is impossible that the parts be produced connected, and go off together into one place. Then again, how are the top & bottom parts, and right & left, and fore & aft, 'sundered'? All these things are nonsensical. (722b17-30, cf. iv 1 764b15-20)

Thus by the conclusion of the criticism of pangenesis, the initial model of GA i 2 is firmly set: the alternative to literal "parts (of the offspring) in the semen" has been established, namely "formative motions in the semen" — but the idea of a "female semen", which would have "motions" of its own, is still ruled out. The catamenia, it is explained, are analogous to the semen in every way, but because the female is weaker and cooler, the catamenia are less completely concocted (the discussion is summed up at i 19 726b30-727a2). The following completes the argument:

Since this [catamenia] is what is produced in females corresponding to the semen in males, but it is impossible that any creature produce two spermatic secretions at the same time [— where, one wonders, did *that* premiss come from?³² —], it is obvious that the female does not contribute any semen to the generation; for if there were a semen there would be no

(31) The same idea may lie behind Empedocles' admittedly obscure allusion to complementary "densities and hollows" in the respective male and female semens (DK fr. 92, from GA ii 8 747a35-b3), criticized severely and at length (747b3 ff.).

(32) Also noted by Platt *ad loc.* (Oxford translation).

catamenia; but as it is, because catamenia are in fact formed, it follows that semen is not. (727a25-30)

It is in this way, then, that the conceptual bind comes about that leads to the inevitable collapse of this part of the theory in GA iv 3: Aristotle has clearly seen some potential merits of the Empedoclean idea that the offspring somehow pre-exists divided between the parents, in the way suggested by the "tallies" (722b11); but that idea has had to be discarded, as having "nonsensical" implications (b30). It should be noticed, however, that the implications criticized are *internal to Empedocles' account, which is preformationist*; something of merit obviously remains to the idea that is applicable to the dilemma Aristotle has fallen into.

In fact, the problem he faced was, and is, of major difficulty. Put in the terms of his preferred account of the matter, the problem is: *how the form of the offspring could be (could have been) divided into two (in the parents)?* Or, since according to him the form is imparted via "motions", *how the sequence of motions that shape up the offspring once the process gets under way, could be understood to have been directed by a formula ("logos") somehow pieced together from two half-formulas ("hemilogoi") emanating from the two forebears?* The twofold root of the problem is the exact nature of the halves or "tallies", and the manner of their combination into a single unity; and it can be thought of (purely heuristically) as a problem that Nature had to contend with long before science began trying to riddle out how Nature had done it. Indeed one way of appreciating its difficulty is to understand something of the way in which it is now thought that Nature solved the problem: by the mechanism of meiosis or *reduction division*, in which the form of an animal species (as carried in the chromosomal material) is reduced, for "spermatic" purposes, by one-half in each parent from a diploid to a haploid condition, and then recombined, diploidized, complete, to constitute the genetic coding (the "formula", in Aristotelean language) for the offspring.

As a consequence, it seems that the male-chauvinist cast to Aristotle's account of generation may not be wholly, though it undoubtedly is partly, ascribable to unexamined biased assumptions concerning the nature of the sexes.³³ It is true that the model of the sexes assumed as *endoxon* is never seriously challenged, and that once the doctrine of concoction of generative residues and the theory of the generative seminal "motions" are worked out, the corollaries of female "powerlessness" (*adunamia*) (e.g. i 20 728a18, iv 1 765b8-15, etc.) and even "defectiveness" (*pêrôsis*) (ii 3 737a18, iv 3 767b8, iv 6 775a15,

(33) Aristotle receives a severe lashing on this latter account in Horowitz (1976); he is judiciously defended, to the extent possible, by Morsink (1979).

etc.) fall out with unfortunate ease. On the other hand, the analysis here points to another source as operational also: *that he was unable to see a way in which the form, i.e., in the context of the general account, the "motions" conferring form, could be divided.* When, in iv 3, "maternal motions" make their sudden and entirely unprepared (although, as we can see, well-enough motivated) appearance, nothing is said on this — obviously critical — point, and the account suffers from the incoherences already mentioned. But the extreme difficulty of the problem in his theoretical terms goes some way in partially explaining both that deficiency and the overall sexist cast.

In fact, it has occurred to me that there was an answer available, in his terms, that he might have, though he did not, hit upon. There is one "division into two" in Aristotle's idea of the distribution of form, that could have been theoretically utilized in this desiderated division of form of offspring between *female* and *male forebear*; and that is the division between *genus* and *species* or *final differentia*.

Here is one way the story could have gone, in which as much of the account as possible is left unchanged. The account of the role of the male remains pretty much as the GA gives it. The female contributes catamenia, also as before. However, the female is further capable of concocting a small amount of her catamenial residue into a formative semen of her own. Because of her cooler nature, as before, however, this female semen is not as powerful as that of the male, and that in two ways. First, male semen is required to start the generative process (this is obviously a point that any theory has to preserve; *ta thêlea ou genna ex haulôn* (722b13), "the females don't generate out of themselves").

Second, female semen lacks the vital heat that is necessary to bring the generation all the way to the ultimate perfection of final differentia; it has a generic formative capacity, but falls short of the fully specific. Thus, the male contribution is required to begin the process and to finish it, but between these extremes, *en lêi mesêi sustasei*, the two semens are in generally equal combat as together they vie to shape the product. (If grandparental motions, etc., are to be brought in, this is also the place for them.) Because both semens are kinetic and poietic in nature, rather than themselves literally *merê-ekhonla* or "part-containing", the outcome of their collision at each point is *one* "part", perhaps resembling one or the other parent; there is no danger of the "double parts" of the sort that repeatedly loomed on the pangenetic/preformationist basis.

The sole purpose of this little sketch (which it should be emphasized is neither history nor science but sheer fabrication) is to illustrate the point that in the scheme as Aristotle gives it, there is *one* place at which Form *does* divide in two in a way that could be theoretically useful in extricating him from his difficulty: and that is between the "uppermost"

parts of the generic structure or "chassis" as laid down in the chronological sequence of formations, and the final differentiation via ultimate specific form. We know that the exploits such a relationship in other connections, such as solving the so-called Unity of Definition problem [§ 23 (iv)], and explaining the "most rightful" sense of both *being* and *one*, that involving an actuality's being-predicated of that whose actuality it is (§ 16). But all the evidence is that the idea of correlating 'the *arkhai* of male *versus* female', not with 'active versus passive', but with 'specific versus generic formative activity', which could have resolved this vexatious quandary in a way basically congenial to the overall view (and when he really needed it), never occurred to him. An so, he had to accept a male-chauvinist consequence, and did so. Like a man.

IV. SHORT RETROSPECT: METAPHYSICS AND METABIOLOGY

I suppose that the main lesson I would like people to take away from this discussion is that Aristotle's metaphysical ideas about from, especially the so-called 'unity' of from, and his biological problem about divided inheritance, are deeply connected.

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THE DEFINITION OF SENSIBLE SUBSTANCES IN MET. Z¹

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It is a common view that according to Aristotle definitions of sensible substances ought to take into account both their form and their matter, viz. that a human being, e.g., ought to be defined as this kind of form in this kind of matter. Thus Ross ("Aristotle", 1949⁵, p. 69) tells us "Though matter is often opposed to definition, the physicist's definition of man, or of any other species, must include a statement of the matter proper to the species". I will call this view "the standard view".

There is a sense in which the standard view, no doubt, is correct. There are a good number of passages in Aristotle where Aristotle would say just this. And it is easy enough to see why Aristotle says this. A sensible substance is a material substance, a composite of matter and form. Hence it is not just some form, but some form in some matter; and for the natural philosopher who wants to understand the characteristic behaviour of sensible substances of the various kinds it is crucial to know what kind of matter a particular kind of sensible substance is realized in; for only thus will he be able to identify and to understand, as fully as possible, the characteristic affections of a sensible substance of this kind.

So a natural philosopher or physicist will define natural substances in terms of form and matter. But we should be hesitant to infer from this that, as the common view has it, the definition of natural substances quite generally for Aristotle is in terms of form and matter. I want

(1) I am greatly indebted to Alan Code, Don Morrison, and Mario Mignucci for their comments on an earlier version of this paper.

to argue that it is only in a special sense of "definition" and in the particular context of natural philosophy that natural substances (and, correspondingly, natural affections) are defined with reference to both matter and form; in the standard sense of "definition", in the sense of "definition" which Aristotle relies on, e.g., in the *Metaphysics*, the definition even of natural substances is solely in terms of form. For Aristotle, following the tradition of Socrates and Plato, also seems to assume that to ask for the definition of an X is to ask for a specification of the essence of an X, for what it is for an X to be an X, for that in virtue of which an X is an X. Thus, in this sense of "definition", the definition of a sensible substance ought to be in terms of its essence, rather than in terms of both its form and its matter.² For according to Aristotle, the essence of an X, that in virtue of which it is an X, is its form (cf. *Mel* Z7, 1032b 1-2; Z10, 1035b 32). And hence one should think that a sensible substance for Aristotle, even though it is a composite of matter and form, is to be defined in terms of its form, and its form alone, since the matter in no way is part of the essence of a sensible substance. And, in fact, this seems to be what he does think. Consider, e.g., *Mel* Z10, 1035b 14-15. Aristotle says: "But [since] the soul of living things is the ousia in the sense of the definition, and the form, and the essence of this kind of body". Here Aristotle clearly identifies (i) the form of a certain kind of living thing, (ii) the essence of that kind of thing, and (iii) the ousia which is specified by

(2) There is a distinction here which one might easily overlook and which one might not even want to make, given the way we talk about definitions, namely the distinction between what is defined, an X, and the essence one specifies in defining an X. The way Aristotle talks, if we ask what a human being is, it is a human being which gets defined by specifying the essence of a human being in the appropriate way. This, so far, leaves it quite open what it is which gets defined when we ask for the definition of a human being; in particular it leaves it quite open whether what is defined, a human being, is identical with the essence of a human being. And for the moment, for reasons which will become obvious soon, this can be left open. Very often, though, this distinction is not made, presumably because it is taken for granted that what is defined must be identical with what is specified as its essence, because it is taken for granted that what is defined must be identical with what it is defined as, given any legitimate notion of "definition". As a result the expression "the definition of X", as often used, becomes ambiguous as to whether the X in question is what is defined or whether it is what is specified as the nature or essence of something, once we make the distinction suggested. Similarly the claim that all definitions are definitions of kinds, species, or ideas becomes ambiguous. It might be the claim that what is defined when we define a human being is a kind, a species or a Platonic idea; or it might be the claim that a definition of a human being has to specify a kind, a species, or an idea. I do not want it to follow from the mere notion of a definition employed here that the two claims amount to the same claim, and hence I want, for the time being, to insist on the distinction.

In terms of this distinction, then, when we ask for the definition of an X, in this sense of "definition", we are asking for the specification of the essence or nature of an X.

the definition of this kind of living thing. But in identifying these three things Aristotle also presupposes that what gets specified in defining a certain kind of sensible substance is its form, i.e. that a kind of sensible substance is defined in terms of its form. And this is just what we should expect if the form is the essence and the definition of a kind of thing gives us the essence of this kind of thing.

Given that we now have both the claim that a sensible substance is to be defined in terms solely of its form and the claim that it is to be defined in terms of both its forms and its matter, and given that these two claims seem to conflict, it is natural to look for a more comprehensive position within which the two apparently conflicting claims can be reconciliated.

Such a more comprehensive position concerning the definition of sensible substances is ready at hand. A definition is supposed to give us a complete answer to the question what something is, to the *ti estin* question. But Aristotle also tells us repeatedly that in the case of material entities there are three ways to answer this question. If the material entity is an X, the question "what is an X?" may be answered (i) by specifying the form of an X, (ii) by specifying the matter and the form of an X, and (iii) by specifying the matter of an X. Consider, e.g., *De an* A 1, 403a 30 ff. There Aristotle says that there are three ways to answer the question "what is anger?" or the question "what is a house?", namely in terms of matter, form, and form and matter.

Now clearly Aristotle does not think that all these are ways of specifying what an X really or essentially is. For he clearly does not believe that what a sensible substance really or essentially is, is its matter. This, he thinks, is what some of his predecessors mistakenly believed. Thus he must assume that there are different ways to understand the question "what is an X?". There is one legitimate way to understand the question such that an answer in terms of the matter will be appropriate; in a way, an object is its material constituents; and there is another legitimate way to understand the question such that an answer in terms of the matter will be inappropriate, whereas an answer in terms of the form will be appropriate, namely if we understand the questions in the sense of "what is an X essentially?". But if, as Aristotle does, we call an appropriate answer to the "what is an X?" question in any of its legitimate uses or senses a "definition", we also, correspondingly, have a wider use or sense of "definition", in which not only definitions in terms of the form or essence count as definitions, but also answers to the question "what is X?" in terms of the matter, or in terms of both matter and form. And so we can say that in one sense of "definition", the traditional, standard sense of the term, the definition of a sensible substance will be in terms of its form or essence. In fact, in the *De anima* passage referred to, Aristotle uses "form" and "logos"

interchangeably (403a 25; 403b 2, 4, 8) obviously because in the standard sense of "logos" or "definition" the form just is what gets specified by the definition. But, e.g., in the same *De anima* passage, there also is another, weaker, yet perfectly legitimate use of "definition" in which the definition of a sensible substance will be in terms of both its form and matter. For, after all, there is a sense in which the right way to answer the question "what is an X?" in the case of a material entity is to refer to both form and matter. More specifically the *De anima* passage suggests (403a 28; 29, 403b 7; 11) that this is the way the natural philosopher or natural scientist will define things, whereas the dialectician will define things just in terms of their form.

Thus the two apparently conflicting claims can both be accommodated within the framework of a more comprehensive position. It is true that there is a traditional standard sense of "definition" in which the definition of a sensible substance is in terms of just its essence or form. But it is also true that there is another, wider sense of "definition", the one the natural philosopher will rely on, in which the definition of a sensible substance can be in terms of both matter and form.

It would be a mistake, though, to think that this is just a terminological matter, that Aristotle, in insisting in *Mel. Z* that the definition of material substances does not involve a reference to matter, is merely insisting on a traditional use of "definition". More is involved, and this is what I want to pursue in the following.

In *Mel. Z* 4-6 Aristotle discusses essence, pursuing the suggestion that *ousiai*, the primary constituents of reality, are essences. In this discussion he relies on the assumption that the definition specifies what the essence is; not surprisingly, given the traditional use of "definition".

But this connection between essence and definition raises certain questions concerning definition which Aristotle deals with in *Z* 10 and the first part of *Z* 11. In the second part of *Z* 11, 1037a 21 ff, Aristotle summarizes his discussion of essence and definition. In the course of this summary he says, 1037a 24-29: "In the definition of the substance the parts in the sense of the matter will not be contained. For they are not part of the substance in this sense, but part of the composite substance. Of the composite substance there, in a way, is a definition, and, in a way, there is not. If taken with matter, there is not, for matter is indefinite; but in accordance with primary substance there is, e.g., in the case of man, the definition of soul." At first sight these remarks are somewhat obscure. But it is clear enough that Aristotle is claiming the following: (i) in the definition of a substance there is no place for a reference to the material parts or the matter of the substance; (ii) there is a sense in which there is no definition of composite sensible substances; (iii) there is a definition of a composite sensible substances

only in the weak sense that there is a definition of the corresponding primary substance, i.e., the form of the composite sensible substance, and that this definition can be treated as the definition of the sensible substance.

These remarks clearly conflict with the standard view from which we started out. For they rule out definitions in terms of both form and matter. But they also show that more than mere terminology is involved. If Aristotle were just insisting on the traditional sense of definition, he would say that the definition of natural substances is solely in terms of their form, that there is no place in a definition, properly speaking, for any reference to matter. But what, in fact, he does say is much stronger; he claims that, properly speaking, material, sensible substances have no definition at all, that they only have a definition in the derivative sense that there is a definition of the form, which, of course, will contain no reference to the matter.

Now these remarks in the summary of the latter part of *Z* 11, if taken seriously, pose a problem not just for the standard view, but for any interpretation of Aristotle's view concerning the definition of sensible substances. Not surprisingly, commentators have looked for a justification not to take them seriously. Hence, given the problems they pose, we should first reassure ourselves that these remarks have to be taken seriously.

Commentators who did not take them seriously did not go very far to find a justification for their dismissal. In the first part of *Z* 11, 1036b 26 ff, Aristotle seems to argue against Socrates the Younger that it would be a mistake to try to define a human being without reference to its material parts. Aristotle says (1036b 28-30): "For the animal is a thing capable of perceiving (reading "aisthetikon" instead of "aistheton"); as far as our argument is concerned nothing really turns on this; we could develop a parallel argument relying on the transmitted reading), and (hence) one cannot define it without motion, and hence one also cannot define it without parts being disposed in a certain way". Here Aristotle clearly seems to say that an animal or a certain kind of animal has to be defined also in terms of its material parts. Hence Ross, in his commentary on 1037a 27, thinks he can dismiss the troubling remarks in the summary by saying: "yet Aristotle has said (1036b 29) that the definition of man must mention his material parts. Of course a definition must not mention prime matter, since that is indefinite, i.e. nothing definite can be said about it but in certain cases the proximate matter must be mentioned." Obviously Ross here tries to defend the unadorned standard view against Aristotle's own remarks. In a similar vein the *Londinenses* (Notes on *Z*, p. 97-98) tell us: "The trouble with the summary is its resumé of *Z* 10-11 at 22-30. It seems to suggest that once matter comes in there is in a way no logos,

logos being of form, e.g. of soul in the case of man — a thesis entirely alien, surely, to the spirit of Z 10-11."

Now, one will readily agree that if the summary does go against the grain of what it pretends to summarize and even clearly contradict it, as it seems to do, little or no weight can be attached to the remarks in the summary, and hence there is no need to go out of one's way to try to accommodate them.

But is it true that the remarks in the summary go against the whole spirit of Z 10-11 and, in one place, 1036b 26-30, even flatly contradict what Aristotle has said there? It does not seem to me to be true that the summary runs against the general drift or spirit of Z 10-11. Z 10 discusses the question how the parts of the thing defined are related to the parts of the definition, and it comes to the conclusion that "only the parts of the form are parts of the definition" (1035b 33-34), but not the material parts like the bones, sinews, and tissues; these are the matter and they form part only of the composite substance (cf. 1035a 18-21). Given this conclusion chapter 11 naturally proceeds to ask what is to count as part of the form, rather than as part of the composite. For, "as long as this is not clear we will not be in a position to define each thing. ... If it is not clear which of the parts are only parts as matter and which not, the definition of the thing also will not be obvious" (1036a 27-31). Thus Z 10-11 in general clearly takes the line that in the definition of a substance there is no place for the mention of material parts or matter.

Hence there does not seem to be any conflict between Z 10-11 in general and the remarks in the summary. What is more, it is clear that if there is a conflict between the remarks in the summary and one particular passage in Z 10-11, namely the remarks about Socrates the Younger, which Ross and other commentators rely on to dismiss the remarks in the summary, it is not the remarks in the summary which stand out as an anomaly in an otherwise unproblematic text. It rather is the remarks about Socrates the Younger which, as standardly interpreted, pose the problem. For, whereas the rest of Z 10-11 argues that in the definition of a substance there is no place for a mention of the material parts, as the résumé correctly summarizes, 1036b 26 ff seem to claim the exact opposite. Thus almost at the outset of Z 11, in 1036b 3-6, Aristotle had pointed out that the form of a human being invariably is found to be realized in tissues, bones, and the like parts, and yet had concluded that these parts were just matter and not part of the form and the definition of a human being. And a few lines further down, 1036b 10-11, he had objected to certain Platonists who claim that the reference to lines and the continuous in the definitions of the circle and the triangle should be eliminated because they have the same status as the tissues and the bones in the case of the human being. And his objection had not been that we cannot eliminate a reference to the

tissues and the bones from the definition of a human being, and that hence the reference to the lines and to the continuous cannot be eliminated from the definitions of the circle and the triangle, either; his objection had been rather that the lines and the continuous in the case of the circle and the triangle cannot be assimilated to the flesh and the bones in the case of human beings, thus suggesting that human beings can be defined without reference to their material parts.

Now the fact that on the usual interpretation 1036b 26 ff claims exactly the opposite of what the two chapters in general try to argue, and of what the summary takes to be a conclusion from these two chapters, should make us doubtful about this interpretation of 1036b 26 ff. But is there any other way to interpret Aristotle's words "and hence one cannot define the animal without motion and hence not without the parts disposed in a certain way, either" (1036b 29-30)?

To form a view on this we need to look at the context. Socrates the Younger, we are told, made a comparison; he compared the case of the animal with the case of something else. Aristotle does not tell us what this something else was, but in view of the comparison in 1036b 27-28 and another comparison earlier in the chapter it is plausible enough to assume that he compared the case of the animal to that of the circle and proposed that an animal or a human being should be defined the way we define circles. Aristotle responds by saying (1036b 26-28): "This leads away from the truth and makes one suppose that a human being can exist without its parts, the way a circle can exist without bronze. But the case is not similar."

Presumably the clue to a proper understanding of these lines lies in the implicit claim that to define a human being the way one defines a circle is to make it appear as if a human being could exist without the characteristic material parts just the way the circle could exist without the bronze. Now there are two ways to understand what Aristotle thinks is going wrong if we define a human being the way we define a circle (i) Circles are defined as if they could exist without the material parts they have. For whatever material parts they happen to have, e.g. brazen parts, they can exist without them. In fact, there is no particular kind of matter circles need to be realized in. When we study circles systematically, namely in mathematics, we at no point have to refer to their material constitution or their material parts. Hence it is perfectly alright to define circles as if they could exist without the material parts or the matter they are realized in. But to define human beings this way would have disastrous consequences. For when we study human beings systematically, namely in natural philosophy, we do have to take into account their material constitution and to refer to their material parts. That human beings have the material parts they have is crucial to our full understanding of how they function and

behave. Hence to define them as if they could exist without their material parts is seriously misleading. (ii) Given that the mathematical study of circles at no point touches on this material constitution we can define circles *as if* they existed separately from matter. We cannot define them *as existing* separately from matter. For this would be a mistake. But we can define them *as if* they existed without material parts. Doing this will not affect the truth of the mathematical views at which we arrive on the basis of such definitions. Such definitions may, of course, mislead somebody into thinking that the entities thus defined can exist without matter altogether, but even this mistake would have no consequences for our mathematics. But if we defined human beings in this way and thus mislead somebody into thinking, not only that human beings can exist without the material parts they have, but without material parts altogether, this would have disastrous consequences for the natural philosopher's study of human beings. One does not fully understand what human beings are and how they function, unless one takes into account that they have material parts.

Whichever of these two interpretations we adopt, it is clear that all Aristotle is saying so far is that, unlike circles, human beings ought not to be defined in such a way as to create the impression that they could exist without the material parts they have or perhaps even without material parts altogether. Note that Aristotle does not say that Socrates' comparison is false or wrong; if this is what he meant he would say it; instead he says that the comparison is not a good comparison to make (*ou kalōs*), that it leads away from the truth, that it is misleading because it could create a wrong impression. And from this it does not follow at all that Aristotle thinks that human beings have to be defined by referring to their material parts. There are other ways to define human beings in such a way as to avoid creating the impression that they could exist without material parts or without the material parts they have. We can, e.g., define a human being as, among other things, capable of perception, more specifically capable of sight, hearing, taste, smell, and touch. For defining a human being in this way we explicitly only refer to its form, or rather to parts of its form. But we do this in such a way as to make it perfectly clear that a human being cannot exist without material parts. For the ability to touch, e.g., does presuppose material parts. And such a definition not only makes it clear that human beings have to have material parts, it also makes it clear that human beings have to have material parts of a certain kind, perhaps even in some sense that they have to have the material parts they have. For how could something be capable of sight without having an eye or eyes? Thus it seems that we could define a human being solely in terms of its form without giving the mistaken impression that human beings could exist without the material parts they have or even without material parts altogether.

It is in this context that Aristotle makes the controversial remark: "For the animal is a certain kind of perceptive being, and it cannot be defined without motion, and hence also cannot be defined without the parts being disposed in some way". (1036b 28-30) Let us now ask again: do we have to understand these words as saying that a human being cannot be defined properly except by referring to its material parts?

It seems to me that this is not so. For: (i) we should note that the phrases "cannot be defined without motion" and "cannot be defined without the parts" are rather ambiguous and need to be filled out on any interpretation; Aristotle does not say "cannot be defined without referring to (or mentioning) motion" or "cannot be defined without referring to (or mentioning) the parts"; he just says "cannot be defined without the parts", and this can be filled out in various ways. (ii) One natural way to fill out these phrases is this: "cannot be defined except as the kind of thing which is in motion", "cannot be defined except as the kind of thing which has parts". But these phrases, thus filled out, in turn are ambiguous. One thing they naturally mean is that we have to have a reference to motion or change and the parts in the definition. But another thing they quite naturally might mean is that we have to define human beings in such a way that it is clear from the definition that they are the kind of thing which is in motion or subject to change and has material parts of a certain kind. On Aristotle's view to define something as capable of sight is to define it as the kind of thing which is in motion or subject to change and has parts of a certain kind. (iii) To claim that the phrase "cannot be defined without the parts" must mean "cannot be defined except with reference to the parts" raises the problem that in this case we have to understand the phrase "cannot be defined without motion" analogously. But it is rather doubtful whether Aristotle thinks that the definition of an animal also has to make explicit reference to motion or change or to a certain kind of motion or change. In any case, Aristotle nowhere else insists that natural substances have to be defined with explicit reference to motion or change. It rather seems to be the case that Aristotle here introduces motion, because it is obvious that the kind of thing which is in motion needs to have the appropriate material parts to be in motion. There is no need to introduce motion or some kind of motion into the definition, because it will follow from the definition, if it is an adequate definition, that the thing defined is the kind of thing which is in motion. (iv) The whole context of Z 10-11, as we have seen, speaks against the assumption that Aristotle here means to say that the material parts have to be mentioned in the definition. Thus I conclude that there is a way of interpreting 1036b 28-30 in such a way as to bring these lines into agreement with the rest of Z 10-11 and its summary.

If this is correct we have no excuse not to take Aristotle's remarks

about the definition of sensible substances in the summary very seriously. But even if the alternative interpretation of 1036b 28-30 suggested here should not be accepted, it still will be the case that it is these lines, rather than the remarks in the summary, which do not fit the context. And hence, even if the suggested interpretation of 1036b 28-30 should turn out to be unacceptable, it still will remain true that the remarks in the summary cannot be written off as a mere slip of some kind; the summary does represent the general view of Z 10-11, from which only 1036b 28-30 would depart. Hence the remarks in 1036b 28-30, rather than the remarks in the summary, should be treated as anomalous and requiring a special explanation. But if this is so, we do have to face the problem after all how the remarks in the summary about the definition of sensible substances are to be reconciled with the standard view.

Now in a way it is rather easy to see what leads to the view of Z 10-11, reflected by the remarks in the summary, and why this brings about the conflict with the standard view on the definition of sensible substances. Usually Aristotle assumes that there are definitions of sensible substances, e.g., a man or a house; he also assumes that, in the ordinary standard sense of "definition", definitions define substances by specifying their essence which is their form. Hence he assumes that what gets specified by the definition of a substance is an essence. But in Z 10-11 and its summary Aristotle goes further: now a definition is a definition of an essence or form not only in the sense that what gets specified by the definition has to be an essence, but in the stronger sense that the thing to be defined itself has to be an essence or form. What gets defined, on the view of Z 10-11, are no longer composite sensible substances, but their forms or essences, man not in the sense of a composite sensible substance, but in the sense of the form of man. Given this it is no surprise that Aristotle should claim that there is no place in the definition of man for a reference to matter or the material parts. And hence it also is no surprise that Aristotle should say that in some sense there are no definitions of sensible substances; for definitions, properly speaking, are of forms or essences and not of composite substances. And we also can understand why Aristotle says that in a sense there is a definition of man, though not of man as a material entity, namely insofar as the definition of the soul in a way can be regarded also as a definition of the composite substance man.

Aristotle in *Mel. Z* (cf. Z 8 1033a 30, 1033b 3) takes the view that what a composite substance really is is its form or essence. Hence the definition of the form in a way also is a definition of the composite substance; for what the composite substance really is is this form. I take this to be central to be Aristotle's view on substance in *Mel. Z*. But to pursue this particular point here would lead us too far away from our present concern.

What still needs an explanation here are at least two things: (i) When Aristotle himself explains here (1037a 27) why there is no definition of, say, man taken as a material entity, he does not say that man, taken in this way, is not an essence or form. He rather gives as a reason that matter is indefinite. (ii) Why does he take the view that only essences, strictly speaking, have a definition?

Ross in this comment on 1037a 27, quoted above, thinks that Aristotle, when he talks about the indefiniteness of matter, is talking about prime matter. Obviously he thinks that prime matter is utterly unspecified and that hence it cannot be specified or that there is no point in referring to it, since it does not serve to distinguish different kinds of sensible substances. But whatever his view may be, it can hardly be correct. For surely nobody is even tempted to define a sensible substance in terms of prime matter. This is not what Aristotle ever has in mind when he talks of definitions in terms of matter and form. And, most importantly, the matter in question throughout Z 10-11 has been, and hence also should be here, proximate matter. But what, then, does Aristotle have in mind when he talks about the indefiniteness of matter, if it is not the indefiniteness of prime matter? The answer clearly is provided by *Mel. Z* 1049b 1-2, where Aristotle again talks about the indefiniteness of matter, and more clearly the indefiniteness of proximate matter. The point is that matter, e.g., gold or wood, is not a definite thing. Hence an object cannot, in some important sense, be said to be wood or gold, but only wooden or golden. Gold or wood, e.g., cannot be what it is to be for an object which is wooden or golden. So an object cannot be defined, in the sense of "definition" which corresponds to "essence", as wood or gold. But, one will object, it could be defined as matter informed by some form or as some form realized in some matter; rather than just as some matter. What this brings out is that because of the indefiniteness of matter something else, something in addition to matter, is needed to get a definite object, namely a form or an essence. But the fact that matter and form in this way are distinct raises a further problem. As it will turn out when we consider our second question, this precisely is the reason why Aristotle here thinks that only forms or essences have a definition. So his explanation that matter is indefinite turns out to be short-hand for a longer explanation: because matter is indefinite it requires a form; but the relation between matter and form is such that their composition lacks the kind of strict unity required of definitions, which only definitions of essences or forms can satisfy.

Let us, then, turn to our second question to see this in more detail: why does Aristotle in Z 10-11 take the view that only a form or an essence, man in the sense of the form of a man, strictly speaking, has a definition? It seems that Aristotle must be relying on Z 4-6 for this

assumption that only a form or an essence has a definition. In these chapters, though, Aristotle nowhere says, just in these words, that only forms or essences have a definition. He does say, e.g., that only primary entities (*protá*) have a definition (Z 4, 1030a 10). And he may mean this to come down to the same thing as saying that only primary substances, i.e., substantial forms and essences, have a definition. But to assume that this is the way to understand the claim that only primary entities have a definition is to make a presumably controversial assumption which would require a long and detailed argument.

Unfortunately there is very little about Z 4-6 which is uncontroversial. Yet there does seem to be a way to show Z 4-6 lead to the assumption that only forms have definitions without getting too involved in controversial claims about these chapters. One thing which is clear from the beginning of Z 4 and from the summary in Z 11 is this: Aristotle thinks that there is a sense of "per se" (which he tries to elucidate at the beginning of Z 4) such that the essence of an X is something an X is per se in the required sense of "per se". Now, if we also assume that here a definition of an X is taken to specify the essence of an X, it immediately follows that only those things will have a definition which are something or other per se. For if there is nothing which they are per se, they also cannot have an essence which they are per se, and hence there is nothing in their case for a definition to specify. Primary entities, we can gather from Z 6, 1031b 13-14, are what they are per se: i.e., if an X is a primary entity, it is an X per se; and if to be an X is to be a Y which is Z, then an X also per se will be a Y which is Z; in any case there will be something which it is per se such that by specifying it in the appropriate way we will have a definition of an X.

The passage just mentioned also gives us a clue as to how something might fail to be something or other which it is per se, and hence fail to have a definition. For things which are said to be what they are per se and primary entities are also characterized negatively as those things which are said to be what they are not in virtue of something else (Z 6, 1031b 13-14). This makes perfect sense: what is X per se obviously is not X per aliud et vice versa. And it also explains why primary entities are those which are what they are per se; if they were what they are in virtue of something else, there would be something else prior to them and they would not be primary (cf. Z 6, 1031a 28-30).

But now we would like to know what it is to be something, not per se, but per aliud. Here another negative characterization may help which Aristotle gives of primary entities when he first mentions them in Z 4, 1030a 10-11. They are those things which are not said to be what they are in virtue of something's being predicated of something else (cf. also 1030a 3-4). Thus we should assume that an X is an X, not per se,

but per aliud, if an X is an X in virtue of some Z's being predicated of some Y, where Z is distinct from Y. But obviously this cannot be what it is for an X to be per aliud, unless it also is assumed that in this case X is distinct from Y or Z or both.

An example may make this clear. A colour is not a colour per se in the required sense. For to be a colour is to be a colour of a certain kind of object, i.e., to be something which is predicated of something else. For the colour is one thing and the object it is predicated of is another thing. Hence a colour is what it is per aliud, namely the object it is predicated of. Nothing would be a colour, unless there was an object of a certain kind it was the colour of. Hence in the required sense there is nothing which a colour could be per se. And hence it cannot have a definition. This fairly clearly is what Aristotle has in mind when he says, 1030a 14 ff, that things other than primary entities, e.g., qualities, do not have a definition, strictly speaking.

But Aristotle at this point also thinks that he has ruled out accidental entities like a white man as subjects of definition, and we have to see whether our understanding of the phrases "being something per se" and "being something per aliud" is sufficient to understand why there could not be something a white man is per se. Now obviously to be a white man is to be a man who is a white, i.e., to be a white man is to be something of which something else is predicated. In fact, Aristotle in 1030a3-4 explicitly classifies the case of a white man as a case in which one thing is predicated of something else and in which, hence, we do not have an essence. It is also clear that a white man is what he is, namely a white man, in virtue of something else, namely in virtue of man and of white, from both of which he is distinct. For a white man is an accidental entity and thus neither a substance, nor a quality. Hence a white man is what he is per aliud.

With this in mind let us see how sensible substances like, e.g., a man fare. Now there are two ways in which we could construe a composite substance, either (i) as a form enmattered in some matter, or (ii) as some matter informed by some form. It is clear from, e.g., 1020a 23-24, that we can also say that a composite substance (i) is a form which is predicated of some matter or (ii) is some matter of which some form is predicated. In either case composite substances are what they are in virtue of something's being predicated of something. Now, if we want to determine whether sensible substances are what they are per se or per aliud, the crucial question clearly is whether the something which is predicated is different from the something it is predicated of. For if it is, then a composite substance is not what it is per se in the required sense. It seems to me that form and matter are distinct in the relevant sense. For otherwise Aristotle could not, in Z 3, define the ultimate subject as what is underlying everything else, i.e., everything other than

the underlying subject, and then continue to argue that in one way matter satisfies this definition because, among other things, it is underlying the form, has the form predicated of it (1029a23-24).

But, one might object, the composite substance is neither distinct from the matter, nor distinct from the form; hence it cannot be what it is *per aliud*. It is difficult to do full justice to this objection without discussing distinctness in considerable detail. But for our purposes it may suffice to remind ourselves of the following: (i) Aristotle does seem to assume that if an X is a Y which is Z and Y and Z are distinct, then X must be distinct from Y or Z. (ii) Aristotle does assume that a white man and a man are distinct, though a white man is a man. The reason must be that to be a white man is one thing and to be a man is another. But in this sense the composite substance also is distinct from both the form and the matter. (iii) A main point of Z 6 is that in the case of things which are said to be what they are *per se* the thing and the essence are straightforwardly identical (1031b 28ff). But clearly composite substances are not straightforwardly identical with their essence or form. Hence they cannot be something *per se*. (iv) On the view developed in Z composite substances are not primary entities precisely because they depend on a form which is prior to them (cf. 1029a 31). So there is at least this sense in which the composite is distinct from the form. (v) If we insist that in a way the composite is not distinct from its form, because, in a way, what it really is is its form, taken in that way it will be distinct from the matter, insofar as the form is distinct from the matter. There are, then, a good number of reasons to think that when Aristotle says that only primary entities have definitions this, given his view as to which entities primary entities are, is taken by him to mean that only substantial forms have definitions. I think that this conclusion is confirmed by 1030b 11-13 and 1031b, 14-15. In both passages Aristotle seems to identify the primary entities with *eide*.

Now, if this is basically correct then the reason why Aristotle in Z restricts definitions, strictly speaking, to forms is twofold: (i) he insists on the traditional sense of "definition" in which a definition of an X specifies the essence of an X. (ii) He takes an essence to be what a thing is *per se*, but uses such stringent criteria for sameness and distinctness, that only forms will be something *per se*, such that, in this stringent sense of "*per se*", only forms have an essence and hence a definition. So it is not just a terminological matter when Aristotle in *Mel. Z* 10-11 insists that there is no place for matter in the definition of natural substances; he has metaphysical reasons for saying this: only forms, strictly speaking, have a definition, and composite substances only have a definition, insofar as the definition of their form can be treated as their definition, because, in a way, they are their form.

If this is the correct view to take, some further problems concerning the definition of substances appear in a somewhat different light.

Obviously Aristotle in *Mel. Z* also is concerned with the unity of definition which he takes to have its foundation in the unity of the thing defined (cf. 1037b 18-20). Thus one reason why he thinks that the proper account (*logos*) of an X fails to be a definition, if to be an X is to be a Y which is Z and Y and Z are distinct items, is that in this case an X would lack the proper kind of unity. The intuition behind this is fairly easy to see: a definition ought to be a definition of some one kind of thing, but though a man is a kind of thing, a white man is not a kind of thing, precisely because it is a certain combination of a kind of thing and something else, a combination which lacks the requisite kind of unity to constitute a kind of thing.

But if we have a definition it necessarily mentions a plurality of things. Take, e.g., a definition in terms of a genus G and a series of differentiae $D_1, D_2, \dots, D_n$. On the face of it, at least, it mentions $n + 1$ items. And thus the question arises how a definition in terms of these apparently many items manages to be a definition of some one kind of thing.

Now there is a companion to the standard view concerning the definition of sensible substances, namely the view that Aristotle solves the problem of the unity of definition by relying on the fact that in some sense matter and form are one, and that the relation of genus and differentia can somehow be assimilated to the relation of matter and form. That this, indeed, is a view Aristotle holds we can see from H6. But if our interpretation of Aristotle's view on the definition of sensible substance is correct, we should expect that his view on the unity of definition in *Mel. Z* is more complex, too. The only place in Z where Aristotle talks about the unity of definition in some detail is in Z 12. And Z 12 does, indeed reflect a more complex position than the standard line on the unity of definition would suggest.

Aristotle takes up the problem of the unity of the thing defined at the beginning of the chapter with these words: "Why is that of whose account we say that it is a definition one thing, as in the case of man two-footed animal?... Why is this one rather than many, namely animal and two-footed?" (1037b 11-14) But he does not go on the answer the question by saying that in the case of a definition *per genus et differentiam* the genus is, as it were, the matter and the differentia the form. He rather considers two possibilities: (i) the genus is absolutely nothing beyond the *eide* under it, or (ii) the genus is something beyond the *eide*, but only in the sense of being, as it were, their matter (1038a 5-6). It seems that the second possibility is the one he standardly is supposed to subscribe to. But this is not what he does here. He leaves it open which of the two views one adopts, and proceeds as if what was specified by a definition in terms of a genus and a series of differentiae was, in fact, constituted by the differentiae alone,

as if in either case the genus was not a proper part of the definition (1038a 8-9). He then goes on to argue that if we have a proper definition with properly chosen differentiae, what is specified by the definition actually will be constituted by the last differentia alone, apparently because this last differentia already by itself implicitly contains all prior differentiae in the series, in the way in which "twofooted" contains "footed" (1038a 19-20; 28-30). Thus the strategy Aristotle is pursuing in trying to solve the problem, clearly is the following: we have a definition in which an X is defined in terms of a genus G and a series of differentiae $D_1, D_2, \dots, D_n$. We can disregard the genus, because, in one way or another, it already is contained in the first differentia. Moreover we can disregard all the differentiae except for the last one, since they are contained in it. Thus all the parts of the definition reduce to one, namely the last differentia. Hence Aristotle concludes (1038a 25-26): "If then the differentia is a differentia of a differentia (i.e., if the thing is properly defined), the last differentia will be one, namely the eidos and the substance." Thus the question of the unity of the definition and the unity of the thing defined is reduced to the question of the unity of the last differentia, and this unity is supposed to be guaranteed if we divide the genus using at each point the appropriate differentia.

Here, then, the unity of the definition is not explained in terms of the unity of genus and differentia, assimilating the relation between genus and differentia to the relation between matter and form, but rather in terms of the unity of the last differentia. And this unity is accounted for in terms of the unity of successive differentiae. If the unity of matter and form comes in at all, it is only at one point in the account of the unity of the last differentia, namely insofar as the unity of the first genus and the first differentia is part of the unity of the last differentia, and it only does so on one of two possible accounts of the genus, namely the one which makes it a sort of matter, rather than absolutely nothing in addition to the first differentia.

However obscure the details of all this may be, one thing does stand out sufficiently clearly: at least in this text Aristotle does not adopt the simple view that the unity of the definition rests on the unity of matter and form or something analogous to it. This perhaps gets even clearer if we take into account the rest of the sentence in which Aristotle states the solution to the problem of the unity of definition: "that last differentia will be one, namely the eidos and the substance". There is a question as to how "eidos" here is to be interpreted, as "species" or as "form". Given that Aristotle in Z assumes that universals cannot be substances, one should think that Aristotle here cannot be talking of the species, since a species is a universal and hence not a substance. Moreover Aristotle at the end of Z 13 himself points out that the conclusion that universals are not

substances raises certain problems (1039a 14 ff.): since a substance cannot consist of non-substances it cannot be constituted by a genus and a differentia. Hence it cannot be defined as if it were. The moral Aristotle seems to draw from this is that the genus — and the differentia — terms have to be reinterpreted metaphysically in such a way that we can say that what is specified by a genus — and a differentia — term is a substance. Hence Aristotle by "differentia" here cannot mean to speak about a universal. But since he identifies the last differentia as the eidos, the eidos in turn cannot be a universal, and hence it cannot be the species. For reasons along these lines I assume that Aristotle by "eidos" here means a form. But if the last differentia in a definition of an X is identified as the form of an X, then the unity of the last differentia is the unity of a form.

So underlying this discussion of the unity of definition in Z 12 we again seem to have the assumption that at least what gets specified by a definition, if not what gets defined, is a form or essence. But given this view, it now also is pretty clear why Aristotle would be hesitant to claim that the unity of definition is based on a unity analogous to that matter and form. For if the unity of what gets specified by a definition is the unity of the form, it should not be the case that this unity is just like the unity of form and matter or even a case of it. When Aristotle in the *De anima*, B 1, 412b 6-9, explains the unity of body and soul, he appeals to the general principle that there are many uses of "to be" and corresponding uses of "to be one", of which "to be an actuality" is the primary and strictest one. Thus to be a composite of matter and form just is to be a certain kind of being with its own peculiar kind of unity. So if something is one in this way, as body and soul are, this does not require any explanation; for to be that sort of thing, a combination of matter and form, just is to be one in this way. But clearly the form is not one on this way. Its being differs from the being of a composite, and hence also its unity differs from the unity of a composite. In fact, given that Aristotle says that the primary sense of "to be" and "to be one" is the one in which an actuality is and is one, we should expect the sense in which the form is one to be more basic than the sense in which the composite is one. Thus if in Z the unity of the definition is to be explained in terms of the unity of the form we should expect Aristotle to be very hesitant to account for this unity in terms of the unity of matter and form or something analogous to it.

To conclude: Aristotle does think that in natural science sensible substances ought to be defined in terms of both their form and their matter. But, unless one sees that it is only in a qualified sense that he subscribes to his view, many details of the discussion in *Met. Z* remain unintelligible or will be misinterpreted to make them fit the unqualified standard view. For in *Met. Z* he clearly takes the position that there is no place for a reference to matter in the definition of a substance, strictly speaking.

SOME REMARKS ON DEFINITION IN *METAPHYSICS Z*

DONALD MORRISON

In his interesting and important paper, 'The definition of sensible substances in *Metaphysics Z*'; Michael Frede distinguishes three views of Aristotle's position concerning the definition of sensible substance:

I ('The standard view'): Sensible substance ought to be defined as this kind of form in this kind of matter.

II ('The explicated standard view'): There is (a) a traditional standard sense according to which definition is solely of essence or form; and (b) a wider sense of definition which the natural philosopher will rely on, in which the definition will be in terms of both matter and form. (Moreover, perhaps (b) is the *real* definition of the sensible substance.)

III ('The more comprehensive view'): (a) above is the *strict* sense of definition and essence, which restricts both to form; (ii) there is a wide sense of essence in which composite substances have an essence, namely their form, and hence a definition in terms of their form; (iii) there is a wide sense of definition in which a composite can be defined in terms of both its form and its matter.¹

Frede's aim is to argue that III, 'the more comprehensive view', is the correct account of Aristotle's position in *Metaphysics Z*. I am convinced that *something like* Frede's 'more comprehensive view' is correct, and that it is surely a more adequate account than either I

(1) There is a further detail of clause (iii) which I find difficult to understand, and would have liked to see explained in more detail. Frede says that in this 'wide' sense, a definition specifies what a thing is and-not just its essence. I would have thought that on Aristotle's normal usage, 'what a thing is' and 'a thing's essence' are synonyms.

or II. However I do not believe that in his view III we yet have the final truth.

As a first step toward improving on Frede's account, it might be useful to examine further his idea, based on *De Anima* I, 403a30 ff., that Aristotle thinks there are three equally legitimate ways of understanding the question 'What is an X?', one to which the correct answer is 'Form', one 'Matter', and one 'This form in this matter'; and further that only one of these ways of understanding the question — the one to which the answer is 'Form' — gives the 'definition' in the traditional, standard sense of the term, and that not all three answers (perhaps only one?) are acceptable ways of specifying what X really or essentially is.

Now whatever we are to make of Aristotle's various remarks concerning the different definitions given by the natural philosopher and the dialectician, to speak of three (equally?) 'legitimate' ways of understanding the 'What is X?' questions seems to me somewhat dangerous. For there is one way of asking this question which was 'traditional' from Socrates onward and which is metaphysically privileged: namely, that according to which the answer to the question tells one what X *really* is. Thus to say, with Aristotle in the *De Anima* passage, that the natural philosopher appropriately gives one answer to the question and the dialectician another, and to *stop there*, is to evade the crucial issue: which of these is asking the question in its traditional or standard sense, i.e., in such a way that the answer is meant to tell us what X *really* is?

Although Frede does not speak of a traditional or standard sense of the question 'What is X?', he does speak of a traditional or standard sense of the term 'definition', i.e. one according to which definition is solely of essence or form.

The best way to regard this claim of Frede's, it seems to me, is to regard it the way he regards views I and II — as being in a way surely right, but in another way not complex enough and potentially misleading. I would argue that the truly traditional sense of 'definition' — the one going back from Aristotle through Plato to Socrates — is that the definition of X is whatever is the correct answer to the 'What is X?' question when it is asked in the traditional way, i.e. as asking what X *really* is. It is true that a traditional Socratic, or at least Platonic, term for what is expressed by the definition is *eidos* or form, so that in this way there is a traditional sense in which definition is of the form. But with Aristotle the issue becomes more complex. For in the Aristotelian context, to say that definition is of the form is to say that it is of the form *as opposed to the matter*. And this is to use the word 'form' in a somewhat different way from Plato, and to make a somewhat different claim. Thus, even though Aristotle may be inclined to say that definition is of the form, to suppose that in saying this he is saying something 'traditional' is somewhat misleading.

These remarks are relevant to Frede's account because in his statement of view II (a) the sense of 'essence or form' has to be, not the Socratic or Platonic sense, but the Aristotelian one in which 'essence' and 'form' are opposed to matter. (The contrast with II (b) makes this clear.)

Furthermore, it is not clear that one may speak, as Frede's formulation of II (a) does, of a sense of definition according to which it is of 'essence or form', as if these two terms were equivalent. In fact Z 5, 1031a7-14, shows that in *Metaphysics Z* at least, the two are not equivalent, since in this passage Aristotle more or less defines 'definition' (*horismos*) as 'the *logos* of the form', but then allows that there may be sense of 'definition' *and* of 'essence' which not only go beyond form to include matter, but go beyond those (which are both substances) to include non-substances!

The foregoing remarks may not seem very helpful in evaluating Frede's view III, since they are directed at view II, but the terminology of view II is taken over by view III. And beyond that, the considerations I have given suggest that view II may not be the best jumping-off point for developing a more comprehensive view. For there is not really a traditional or standard sense in which definition is of form *as opposed to matter*. There is a traditional and standard sense in which definition expresses essence, but this is just the sense in which 'definition' is understood as 'whatever the correct answer is to the "What is X?" question, when that question is understood in its traditional sense as asking what X *really* is'.

View II suggests that in order to understand Aristotle's theory, we should proceed from the idea that different research purposes yield different definitions. I would suggest a different starting-point, namely the idea that different *entities* yield different definitions. Frede speaks of 'Aristotle's position concerning the definition of sensible substance' as if it were clear that Aristotle has a single position on the issue, or that all sensible substances are, according to Aristotle, sufficiently alike that one should have a uniform view as to how they should be defined. Whether Frede would want to explicitly endorse either of these theses, I do not know. In any case, I would argue that both are false. *Metaphysics Z* is concerned with 'sensible substance'; that is, more precisely, with perishable substances having sensible (as opposed to merely intelligible) matter. But these substances come in three crucially different kinds: i.e., matter, form, and the composite.² Moreover, *Metaphysics Z* is not

(2) Of course they come in many other different types as well, e.g. animal, vegetable, and mineral. But these distinctions are, Aristotle believes, not as crucial for the theory of first principles.

concerned with just any sensible substance. Its goal is to determine which of them is *primary substance*. If 'sensible substance' in its ordinary sense — the rock or dog or philosophy professor in its full concreteness — is *not* primary substance, then *Metaphysics Z* is not primarily concerned with sensible substance in its ordinary sense, but rather with this other thing, primary substance. But Frede and I and most (but not all) other interpreters agree that Aristotle's view in *Z* is that 'sensible substance' in its full concreteness is *not* primary substance.

Since in *Metaphysics Z* sensible substance splits into three different kinds of substance, the question of 'the definition of sensible substance' splits into three questions. For each kind of sensible substance *X* (e.g. tree, dog, human being), there is: (1) What is the definition of the matter of *X*? (2) What is the definition of the form of *X*? and (3) What is the definition of the composite of the matter and form of *X*? Aristotle makes clear in *Z* 3 his view that matter, as such, is undefinable; from which it follows that there is no answer to question (1). He also makes clear in *Z* 3 his view that of the three possibilities, matter, form, and composite, the primary substance is form. My proposal is that the way to understand Aristotle's remarks concerning definition in *Metaphysics Z* is to see him as being concerned primarily with the problem of defining *primary substance*, i.e. with defining *form*.

I am not sure that Frede would disagree with this proposal. But it does seem that, in his interpretation of Aristotle's remarks on definition in *Metaphysics Z* 10-11, Frede agrees with his 'traditional' opponents — Ross and others — in interpreting Aristotle there as being concerned with the definition of sensible substance in the ordinary sense. Ross thinks that *Z* 10-11 uphold the view that the definition of sensible substance includes mention of the matter, whereas Frede argues the opposite. Denying the common assumption that Aristotle is concerned in these chapters with 'sensible substance' in the ordinary sense allows one to resolve the dispute in a different and better way. The arguments which Frede so ably presents that Aristotle's aim in *Z* 10-11 is to argue that the definition of substance contains mention of the form (and of the parts of the form) alone, are convincing. But 'the definition of substance' in this conclusion should be taken as 'the definition of *primary substance*', that is, of form, and not taken either unrestrictedly, as applying to all kinds of substances, or as applying to sensible substance in the ordinary sense.

On the other hand, Ross and the 'traditionalists' are correct in holding that in *Z* 10-11 Aristotle retains the view presented in other works that the definition of sensible substance with which natural philosophy is concerned must mention both form and matter. The way to resolve the apparent conflict between this view and the view that the definition of primary substance is of form alone is not to appeal to two

different senses of definition, one strong and one weak.³ Nor is it to suppose that the metaphysician and the natural philosopher have two different purposes, or theoretical interests, which lead them to define the same thing in different ways. Rather, a better way to resolve the conflict is to understand that the metaphysician and the natural philosopher are trying to define different things. The metaphysician is trying to define primary substance, which turns out to be form, while the natural philosopher is trying to define sensible substances in the ordinary sense, which turn out to be, on Aristotle's analysis, the composite substance, i.e. matter and form together.

So far my remarks have been quite general; now I shall try to show how they apply to the text of *Z* 10-11. Frede writes as if the consistent doctrine of *Z* 10-11, and not just of the summary he quotes from 1037a24-29, is that there is definition only of the form and there is no definition of the composite substance. This seems to me not true. Notice, first, that *Z* 10 begins by asking whether the parts of the formula are present in the formula of the whole or not. This question is asked in an unrestricted form. It applies to everything which has a definition and a formula. Since *Z* 4-5 have made clear that even accidental entities like 'white man' have a formula in a sense, it seems safest to assume this question, as it is initially asked, applies even to the definitions of such entities. This assumption is confirmed at 1034b32-34, where Aristotle first acknowledges a wider sense, and then explicitly narrows the question to the definitions and formulae of *substance*. In the immediately following lines he declares that there are three kinds of substances: matter, form, and the composite of the two. His point is that the original question must be divided into three parts: we must ask it separately about each of the three kinds of substance.

Aristotle says (1035a2) that the matter is in a way a part of a thing, and in a way not, but only (those entities are parts of the thing) out of which the formula of the form consists. He explains what he means thus: bronze is a part of the composite statue, but not of the statue spoken of in the sense of form (*lou hos eidous legomenou andrianlos*). For the form, or the thing as having form (*hei eidos echei*) should be said to be the thing, but the material element (*lo hylikon*) must never be said to be the thing *per se*.

Aristotle's language here is somewhat obscure. If we may assume that 'the thing as having form' is the composite, and the 'material element' is the matter, then what he is trying to say may be explained as

(3) I do not dispute Frede's claim that Aristotle has a doctrine of different senses or degrees of definition (although the point is controversial), nor that the doctrine applies here. What I shall argue is only that appealing to these different senses is not the best way to resolve the conflict.

follows. A substance term like 'statue' is ambiguous: it can be used to refer either to the form, or to the matter, or to the composite. These three meanings can be reduced to two if we restrict ourselves to *per se* senses: 'statue' refers *per se* only either to the form alone, or to the composite of matter and form. In the sense in which a statue is the composite, matter is a part of it, and in the sense in which a statue is the form alone, the matter is not a part.

How are these remarks, which concern the parts of a substance, relevant to the main question of Z 10, which concerns the parts of the *definition* of substance? At the very beginning of Z 10 (1034b21) Aristotle remarks that the parts of a thing and the parts of the formula must be in some kind of correspondence. At 1035a22 ff. he uses this principle to conclude that, just as the name for a kind of substance (e.g.; 'statue') can be used to refer to two kinds of substances, so also one substance-term has two different definitions, one for each type of substance referred to. Just as matter is part of the composite, but not of the form, so matter will be mentioned in the definition of the composite, but not in the definition of the form.

Frede argues that Aristotle's position in Z 10-11 is that the composite has no definition. I take 1035a22 ff. to be incompatible with that claim.⁴ On the other hand, in the immediately preceding line (1035a21) Aristotle uses language which suggests that Frede is right. Aristotle says there that halves of a line or the bones and flesh of a man "are parts of the composite, but not also of the form, i.e. of that of which the definition is (*lou eidos de kai hou ho logos oukeli*). Therefore they (the material parts) are not present in the definitions." Here Aristotle does use the term 'definition' in a way that is restricted to form. But the context suggests that this is a special use of the term, and that Aristotle was intentionally using it in a special restricted way. First, at 1035a4 Aristotle uses the phrase 'the definition of the form'. In this phrase, 'of the form' has restrictive force: it excludes other types of definitions, e.g. of the composite. If it were true that Aristotle were using the term 'definition' in such a way that all definitions are of the form alone, then the phrase 'of the form' would be redundant. So the fact that he does use this phrase gives us reason to believe that Aristotle does not restrict his usage of the term 'definition' in this way, either at 1035a4 or 1035a21. A better explanation of 1035a21 becomes available when one realizes that in 1035a9-21 Aristotle is discussing a pair of examples, circle and syllable, in which both terms are taken in the sense in which they refer to the form alone. That is, Aristotle is discussing the definition of the circle *qua* form, and *in that*

(4) As is 1035a28. 'Those whose definitions are of the form only' is contrastive, implying the existence of things whose definitions are *not* of its forms only.

context it is legitimate for him to refer at 1035a21 to 'the form, i.e. to that of which the definition is.'

However, Aristotle does not say *explicitly* at the beginning of this stretch of text that he is going to discuss 'circle' and 'syllable' only in the restricted sense of 'form'. In that maddening way of his, he simply begins to discuss 'circle' and 'syllable' in such a way that what he says only makes sense on the assumption that they are restricted to form. Therefore, the text of this passage, when taken by itself, is compatible with a reading according to which Aristotle is discussing the definition of 'circle' and 'syllable' in general, and supposing that the definitions of these are always of the form alone. But such a reading is incompatible with the conclusion drawn from the passage at 1035a21-23 that two kinds of definitions are possible. The only consistent reading of the passage 1035a4-23 as a whole is to assume that the examples discussed in 1035a4-21 are implicitly restricted to substance-as-form. And on that assumption the identification of form and definition at 1035a21 does not have universal force.

Thus, through the first half of Z 10 at least, Aristotle does allow that the composite of matter and form has a definition which includes reference to both matter and form (and to their parts). On the other hand, Frede is right to insist that in the summary at the end of Z 11 (1037a24-29) Aristotle does deny that composites can be defined in this way. Frede implies that this summary accurately represents the consistent doctrine of Z 10-11. But now we are in a position to see that Aristotle's remark in this summary is in contradiction with at least the first half of Z 10.

At this point it is useful to draw attention to a peculiarity of Frede's view III. View III is introduced as a 'more comprehensive view' which enables one to reconcile various tensions in Aristotle's thought and texts. But view III, as stated by Frede, explicitly contradicts Aristotle's summary at 1037a24-29. There Aristotle claims that there is no definition of the composite in terms of both form and matter; but according to clause (iii) of view III, there is such a definition. This contradiction poses no serious problem for Frede's view.⁵ He would presumably explain that in 1037a24-29 Aristotle is

(5) However this contradiction does complicate Frede's criticism of the London commentary's comment on the summary. He quoted the remark that 'the trouble with the summary is... it seems to suggest that once matter comes in there is in a way no logos... A thesis entirely alien, surely, to the spirit of Z 10-11.' (*Notes on Book Zeta of Aristotle's Metaphysics*, Oxford 1979, pp. 97-98.) The wording of this remark suggests that what the 'Londonienses' object to in the summary is that it implies: (a) in a way there is no logos which mentions the matter. But what the text of the summary implies is rather this: (b) in a way there is no logos of the composite, namely when that logos includes the matter. In other words, the text implies that (c) *in no way* is there a definition of the

using the term 'definition' in the two stronger senses described in view III, clauses (i) and (ii). It is open to him, or to someone wishing to defend a view like his, to resolve the contradiction between the first part of Z 10 and the summary at Z 11, 1037a24-29 in a similar way, by claiming that in the first part of Z 10 Aristotle is still using 'definition' in the weak sense of view III, clause (iii), while at Z 11, 1037a24-29 he is using 'definition' in the two stronger senses specified by clauses (i) and (ii). Since Aristotle is — intentionally — using the term 'definition' in different senses in the two different places, he commits no contradiction.

This resolution of the conflict is elegant and attractive. But anyone who would defend it owes us an account of where in the intervening text Aristotle (a) introduces the two new senses of 'definition' specified in III (i) and (ii), and (b) argues that the sense of 'definition' employed in the first half of Z 10, which allows that composites can be defined via mention of by matter and form, is not just weaker than the others, but is illegitimate — sufficiently so that this sense is appropriately dropped from the summary at Z 11, 1037a24-29.

I myself cannot discover any place in the stretch of text from 1035a23 to 1037a24 where Aristotle can convincingly be argued to do either (a) or (b). In their commentary to *Metaphysics Z*⁶, Frede and Patzig argue that Aristotle tries to do (b) at 1035b27-34. Unfortunately this passage is very difficult, and the Frede-Patzig interpretation of it is complicated by the fact that this text is crucial for their thesis concerning the role of universals in Z — an issue which does not concern us here. In brief, however, my reasons for doubting that Aristotle can be doing either (a) or (b) in this passage are these:

(1) The initial premise which guides the argument in this section is that at least some of the parts of the definition are prior to the definition itself (1035b4-6). Since matter is posterior to the form and to the compound (1035b12; see Z 3), it follows that there is no definition which mentions only matter. But this principle is too weak to rule out definitions which include mention of matter along with other things!

composite which includes mention of the matter. What the Londonienses really object to in the summary is not (a), as the remark quoted above misleadingly suggests, but rather (b) and (c). This is made clear by their statement a few lines later: "but this should not withdraw the sense in which there is λόγος ταύτης [= τῆς συνόλης οὐσίας] as including a type of matter." But Frede agrees with the Londonienses that there is this sense, and that nothing Aristotle says in Z 10-11 should withdraw it: for this is the 'wide' sense of definition specified in view III clause (iii). Thus, Frede and the Londonienses agree that Aristotle does not really mean what he seems to say in the summary in the unrestricted way that he says it. What they disagree about is whether the texts which show that he cannot really mean this appear in Z 10-11 (the Londonienses) or only elsewhere (Frede).

(6) *Aristoteles 'Metaphysik Z'* (München: Beck 1988) II, *ad loc.*, see esp. p. 191.

(2) It is true that Aristotle in this passage uses his word for 'definition' (*logos*) in place of 'form'. He speaks of 'a certain composite of this *logos* and this matter' at 1035b29. And at 1035b33-34 he says that 'only parts of the form are parts of the *logos*', which sounds like it might be an assertion of (b). But at this point the importance of being sensitive as to whether Aristotle is talking about substance in general, or only about first substance, becomes apparent. For the remarks at 1035b29 and 33-34 must be read in light of the assumption which Aristotle introduces at 1035b15, namely that the *ousia* of a living being is its soul. By this Aristotle means, of course, that the *primary ousia* in the case of a living thing is its soul. From that point on, through the end of the section at 1036a12, when Aristotle speaks of the *logos*, or of the '*ousia* according to the *logos*', he does mean the form of the thing, but not because it is the only substance or the only definable substance, but because it is the *primary* substance. The claim at 1035b33-34 that 'only parts of the form are parts of the *logos*' should not be read as an unrestricted claim about definition in general, but instead as a restricted claim about the definitions of the primary *ousiai* of living things.

If, then, Frede and Patzig are wrong to think that Aristotle tries to do (b) at 1035b27-34, and if no other such passage can be in which Aristotle can plausibly be claimed to do (a) or (b) can be found, then the suggested 'elegant' way of reconciling Z 10, 1035a21-23 and Z 11, 1037a24-29 fails. In that case, we are forced to conclude, with the Londonienses and against Frede, that the summary at Z 11, 1037a24-29 is contrary to the spirit of the rest of Z 10-11. Nonetheless one can agree with much of what Frede says about 'the general drift or spirit of Z 10-11', although with a twist. The twist is that what Frede interprets as remarks about definition in general, should instead be taken as remarks about the definition of primary substance. Z 10 concludes that only the parts of the form are parts of the definition of *primary substance*. This conclusion provides the basis for Aristotle's discussion in Z 11: he asks, "Which parts are parts of the form?" in order to get clear about which parts are included in the definition of *primary substance*.

Recall the distinction made earlier between three different 'What is X?' questions. Leaving 'substance as matter' aside as indefinable, paralleling these 'What is X?' questions are two different questions one can ask about the inclusion of matter in the definition: (1) Is matter included in the definition of the composite? (2) Is matter included in the definition of the form? To these two questions we may add a third: (3) 'Is matter included in the definition of the primary substance?' In his paper, Frede has argued that in Z 10-11 Aristotle's answer to the first question is 'No', whereas I have argued that it is 'Yes'. But Frede and I agree that Aristotle holds the second and third questions to be

ultimately the same (since form is primary substance) and that his answer to both is 'No'. Aristotle argues in Z 11 that the parts of the matter of a compound substance — e.g. the flesh and blood of an animal — are parts *only* of its matter *and not also* of its form.

This aspect of Frede's view deserves emphasis, because it runs counter to an important line of interpretation. According to this interpretation, not only does the definition of the composite substance include mention of the matter; so does the definition of the *form* of a composite substance. Why? Because the form of a composite substance is like 'snub'. 'Snub' is a certain shape or form of nose; thus 'nose' is the matter together with which 'snub' combines to form a composite substance (or quasi-substance, since bodily parts are not proper substances on Aristotle's view). But it turns out that, although 'snub' is the form of the matter 'nose', it is impossible to define 'snub' without including matter in the definition: for 'snub' is 'concavity in a nose'. Now it is easy to see how one might be led to put (a) Aristotle's remarks about definition in Z 4-5, which include a discussion of 'snub', together with (b) his remarks in *de Anima* and in the *Physics* that the definition of a natural substance must include mention of the matter, and (c) the idea that definition is of the form, to obtain the view that Aristotle's theory is that in the case of natural substances, the definition of the *form alone* must contain reference to the matter. When one puts these elements together with (d) the standard interpretation of the Socrates the Younger passage, according to which Aristotle is there saying that one cannot define 'animal' without mentioning its matter, the resulting, very plausible and powerful view, is that Aristotle consistently, throughout *Metaphysics Z* and indeed throughout the *Metaphysics*, and in his works on natural philosophy, maintained the doctrine that the *form* of a natural substance cannot be defined without mention of its matter.

This view has one major philosophical advantage over its denial. This view can easily explain how it is that immaterial substances, i.e. forms which are not conjoined with matter, are metaphysically prior to and have a higher degree of being than the primary substances found in the world of change, i.e. forms which are conjoined with matter. For, as Frede points out, Aristotle holds that (a) whatever is prior in definition is metaphysically prior to⁷ and has a higher degree of being than what is posterior, and one way in which one

definition can be shown to be posterior to another is if it contains elements which are predicated of each other, while the other definition does not. Since, on this line of interpretation, the definition of the form of a natural substance contains reference to both form and matter, one of which is predicated of another, whereas the definition of immaterial substance does not, there is a clear sense in which the form of a natural substance is posterior in definition to immaterial forms, and hence metaphysically posterior and less real. In other words, the very metaphysical disadvantage which Frede argues that composite substances have when compared to their forms, this interpretation claims enmattered *forms* to have when compared with immaterial forms.

Contrary to this line of interpretation, Frede argues — and I agree — that Aristotle's considered opinion, presented in Z 10-11,⁸ is that the definition of the form of a sensible substance does not make reference to the matter. Therefore we cannot explain Aristotle's view that immaterial forms are metaphysically prior to and simpler than enmattered forms by pointing to any such difference in their definitions. Indeed, given what Aristotle says about priority in definition, there does not seem to be any way in which someone who took our position on enmattered forms could claim that immaterial forms are prior in definition to enmattered ones. Therefore, Frede and I, and those who agree with us, face the task of explaining the greater simplicity and metaphysical priority of immaterial forms in some other way. The metaphysical priority of immaterial forms *could* be explained by their role as first causes of motion. But this, by itself, is not a very satisfying explanation, first, because their being first causes is a relative property of these substances (it results from their being objects of desire) and is not intrinsic to them; and second, because it does nothing to explain their simplicity. One place to look for a better explanation may be this. The primary substances of the natural world are not just enmattered forms; they are *souls*. And those substances which are prior to the substances of the natural world are not only immaterial forms; they are also souls. But the souls of mortal substances are rather complicated: they must extend throughout the matter of their substance, and they must care for nutrition and growth; in some cases they originate motion, have memories, make plans, and even philosophize. Even the souls of the heavenly bodies, which are enmattered but eternal, are complicated to this extent, that they originate motion and have a desire for something different from themselves. But immaterial substances are souls which are as simple as

(7) In the general sense of being prior in the overall ranking of substances. Aristotle also has a narrow, technical sense of *prôle ousiai* which only has to do with capacity for independent existence. This narrow sense of ontological or metaphysical priority is, I would argue, only one, and in the end not the most important, of Aristotle's criteria for metaphysical priority in the general sense.

(8) I leave aside here the questions of how Z 4-5 should be interpreted and how the interpretation of these chapters can be integrated with the interpretation of Z 10-11.

a soul can get: all there is to them, so to speak, is the thought of their own essence. Thus, although this idea would require more detailed development to be convincing, it at least seems possible that Frede's line of interpretation can explain the simplicity and metaphysical priority of immaterial forms, not on the basis of their greater unity of definition, but instead on the basis of their greater unity of soul.

So far I have discussed Aristotle's views concerning the three questions distinguished on p. 134: (1) What is the definition of the matter of X? (2) What is the definition of the form of X? and (3) What is the definition of the composite of the matter and form of X? To make progress on the issues raised by Frede in his paper, Aristotle's understanding of a fourth verbal formulation must be clarified, namely the simplest one: (4) What is (the definition of) X? At the beginning of his paper, Frede claims that Aristotle thinks (4) can legitimately be understood in three ways, as equivalent to each of (1), (2), and (3). By the time he presents view III, it is clear that Frede thinks Aristotle's view is that, taken in its strictest sense, (4) is equivalent to (2).

On the other hand, there is good evidence that in Z 10-11 Aristotle holds that (4), taken in its strictest or proper sense, is equivalent not to (2) but to (3). 'What is man?', taken in its strictest sense, is equivalent not to 'What is the form of man?', but to 'What is the composite of man's form and matter?'

The textual evidence for Aristotle's understanding of the 'What is X?' question in Z 10-11 is found at 1035b1, 1037a6, and 1035b27-30. Unfortunately 1035b1 does not by itself help either case, since nothing in the surrounding context suffices to determine whether the crucial phrase 'the circle spoken of absolutely' should be taken as referring to the form of the circle alone, or to the composite. On the other hand, the text of 1037a6 provides straight-forward support for the view that such terms refer to the composite: "It is clear that the soul is the primary substance, the body is matter, and the man or the animal is the composite of both *qua* universal." These words imply that if one asks 'What is primary substance?', the proper answer to give is 'the soul'; and that if one asks 'What is man?' or 'What is animal?', the proper answer will specify the composite of soul and body, taken universally — i.e., just the sort of answer that Aristotle tells us in *De Anima* and elsewhere is proper for the physicist.⁹

(9) To avoid possible misunderstanding, it is important to distinguish yet a fifth question: (5) What is *this* X? For example: What is this animal? What is Socrates? What is Coriscus? Aristotle tells us at 1037a7-9 that *this* question, unlike the previous two, is ambiguous, and in one way should be answered in terms of the soul, and in the other in terms of the composite.

By contrast, 1035b27-30 is the farthest thing from straight-forward. But fortunately its complexities do not much affect the present point. A reasonable translation of the sentence is: "Man and animal and terms applied to particulars in the way that these are, but universally, are not substance but a sort of compound of this formula and this matter taken universally." However the other details of this vexed sentence are to be understood, the important point for us is that here Aristotle evidently treats 'man' and 'animal' in the way that 1037a6 does, as the composite taken universally.¹⁰

If this interpretation of Aristotle's understanding of the 'What is X?' question is correct, the way is opened for a different resolution of the apparent conflict between the metaphysician's and the physicist's definitions than the one given by Frede. For if this interpretation is correct, then the metaphysician and the physicist are not asking the same question understood in two different ways, but rather two different questions. The physicist, looking at man, asks 'What is man?', and answers the question, correctly, in terms of body and soul. The metaphysician, looking at man, asks 'What is the primary substance here?' and answers the question, correctly, in terms of man's soul alone.

Finally, a few remarks by way of summary and conclusion. I agree with Frede that Aristotle has a notion of different degrees or kinds of essence and definition, and that this notion is important to his theory of substance. (It makes a difference whether one interprets these as 'degrees' or 'kinds' or 'senses', and how one explicates these concepts. But that is a large issue I leave aside here.) It seems to me that 'definition' and 'essence' vary in tandem, and thus I have argued against Frede's view that at a certain point they come apart. ("There is a wide sense... in which the definition specifies not just the essence." [p. 116]) Although, again, it would be a large project to discuss this fully, I would argue that a thing's degree or sense of being an essence, and its degree or sense of having a definition, are two different ways of expressing philosophically the same basic fact, one which depends on the unity of the thing defined.

I have also disagreed with Frede, and agreed with the Londonien-

(10) This passage is vitally important to Frede and Patzig's overall interpretation of Z, since they interpret the passage as providing direct evidence that Aristotle denies that universals, or 'things taken universally' are substances; and they use this as a crucial premise in their argument that Aristotle does not believe that universals even exist. Therefore it may be worthwhile to point out how the recognition that Aristotle often uses the word 'substance' in Z where he means 'primary substance' makes available (though it does not force) a reading of 1035b27-30 which avoids this implication. On this reading, all Aristotle means to say in 1035b27-30 is that "man and animal and terms applied to particulars in the way that these are, but universally, are not *primary* substance, but a sort of compound..."

ses, concerning the interpretation of Z 10-11, arguing that these chapters do allow that the composite has a definition. Again, a full defense of this view requires much more discussion — ultimately, a line-by-line commentary on the text of both chapters, something which I have not produced, but Frede and Patzig have!

The position of critic and commentator can be a relatively comfortable one. In conclusion, let me stick my neck out also, and present this counterproposal for a 'more comprehensive view': (i) There is a strict sense of having an essence, or rather of being something which has an essence, in which only immaterial forms are essences and have definitions. (This sense falls outside of the scope of Z and thus of Frede's paper; but it is important to keep it in mind. This is the sense in which the Prime Mover is the answer to the question of Z 1: What is *ousia*?) (ii) There is a looser, but still strict sense of being an essence and having a definition, in which enmattered forms are essences and have definitions. (iii) There is a wider sense in which composite substances have an essence and a definition, namely in terms of their form and their matter. (iv) There is a sense in which a composite *is* its form, and in this sense its essence is its form alone, and it is defined in terms of its form alone. But this is not a sense of definition in which either the physicist or the metaphysician is primarily interested. The physicist is not much interested in this sense, because he will define composites as in sense (iii). The metaphysician, on the other hand, is interested in this sense, because it contributes to his general analysis of sensible substance. He has a deeper interest in it, because the thesis that form is the essence (= *ousia*) of the composite is an important premise in an argument that form is substance (= *ousia*) at all. But the metaphysician need not decide *between* this definition of the composite and the preceding one. There need not be any single 'metaphysician's definition' of the composite, in the way that one expects there to be a single 'physicist's' definition. For the metaphysician it is enough to distinguish the two ways in which the composite can be defined, for then he can use both of them in the premises of arguments toward his real goal: which is to determine what, of all the items in the world, is *primary substance*.¹¹

(11) In addition to debts shared by all participants in the Conference, I have some personal ones to record. Above all, thanks are due to the Alexander von Humboldt Stiftung for its exceedingly generous financial support, which not only gave me the leisure in which to prepare this commentary, but also subsidized travel costs to and from the Conference. I am grateful also for the kind scholarly hospitality of Mario Mignucci and Walter Cavini, whose loan of books from their personal libraries made it possible for me to finish this essay while visiting their home cities. Finally, thanks are due to Michael Frede, *sine quo non*.

ARISTOTLE ON MEANING, NATURAL KINDS AND NATURAL HISTORY

DAVID CHARLES

In this paper, my aim is first to sketch an account (in some places, no doubt, somewhat controversial) of Aristotle's views on meaning and definition in *Posterior Analytics* II. 8-10. Then I will argue that we can see certain elements of these views at work and being further developed in Aristotle's biological writings, when he considers how to establish the existence of kinds of animal. In this way, the biological writings offer insight into Aristotle's account of scientific method which builds on, but also goes beyond, his brief, and occasionally telegrammatic, comments in the *Analytics*. Since this paper is, in part, an attempt at an overview of several areas of Aristotle's writings, more will need to be said about many of the individual claims. However, even an outline map may have its uses if it serves to show what needs to be done, and perhaps (even inadvertently) what should be avoided, in a full, and systematic, investigation of these difficult texts.

I. THREE STAGES OF ENQUIRY

The opening lines of *Post. An* II.10 suggest an account of scientific enquiry which involves three-stages:

Stage I: this stage is achieved when one knows an account of what a name or name-like expression signifies;

Stage II: this stage is achieved when one knows that what is signified by the name or name-like expression exists;

Stage III: this stage is achieved when one knows the essence of the object or kind signified by the name or name-like expression.

Thus Aristotle writes:

Since a definition is said to be an account given in reply to the "What is —?" question, it is clear that one sort will be an account given in reply to the question "What is it that a name or name-like expression signifies?" An example of such a question is "What is it that 'triangle' signifies?" When we grasp that what (it is that) is signified exists, we seek the answer to the "Why?" question. It is difficult to understand in this way (*viz* through gaining an answer to the "Why?" question) things which we do not know to exist. (93b29-33).

If Aristotle does commit himself to a 3-stage view of this type in this passage, two consequences immediately follow.

(a) It is not required in knowing a defining account of what a name or name-like expression ([e.g.] for a kind) signifies that one knows that the kind exists or is instantiated.

(b) It is not required in knowing a defining account of what a name or name-like expression (e.g.) for a kind signifies that one knows anything of the internal structure possessed by members of the kind — even that it has one. For that understanding will be supplied by an answer to the "Why?" question at stage three. At the initial stage the ordinary thinker may have no view as to the connexion of his usage with scientific definition.

I have argued elsewhere that an analysis of *Post. An.* II favours the attribution to Aristotle of this three-stage view of scientific enquiry, in which the first stage is neither existence-involving nor essence-involving.¹ According to this interpretation, possessing an account of

(1) In Aristotle on Meaning and Natural Kinds (1986, Society for Ancient Greek Philosophy, St Louis). I take the phrase '*horismos tis*' in 93b30 as indicating a sort of definition in the *alienans* use in which (e.g.) self-control is a sort of virtue, although not a proper virtue (NE/EE. 1128b34). In 93b37, Aristotle refers to what has been given in 93b30 ff as one definition (*horos*) of definition (*horou*), rather than itself as one definition (*horos/horismos*). This seems to indicate his reluctance to describe the first type of account as a definition (*horismos*) without qualification. Thus, I would take the three unqualified definitions (*horismoi*) referred to at 94a11-14 to be the three specified in 94a2-10, and thus not to involve the initial *horismos tis* which is only a qualified sort of definition. That Aristotle in 93b29-32 does take account of what terms signify as definitions of a sort seems required in the context. The argument runs:

1. $\forall x [x \text{ is a definition of } F \leftrightarrow x \text{ is an account of what } F \text{ is}]$
2. $\forall x [x \text{ is an account of what 'F' signifies} \rightarrow x \text{ is an account of what } F \text{ is}]$
3. $\forall x [x \text{ is an account of what 'F' signifies} \rightarrow x \text{ is a definition of a type of } F]$

3 is obvious (93b29), but this is only if 2. is obvious. And this in turn will only be obvious if all accounts of what 'F' signifies are accounts of what F is — examples of answers to the 'What is F?' question with 'F' substituted for F. If so, an account of what 'goatstag' signifies (92b5-6) will be an account of what a goatstag is, and so a definition of a sort of goatstag (even if goatstags lack unqualified definitions). This account needs further defence than I can give it at this point. For a contrasting view, see Devereux and de Moss: *Phronesis* 1988. Essence, Existence and Nominal Definition in Aristotle's *Post. Analytics* 11. 8-10.

what a name signifies provides one necessary condition for knowing non-incidentally that (e.g.) a kind exists. To establish that it does in fact exist (at least in the range of cases under discussion in II.8) involves finding a middle term which allows one to demonstrate that (e.g.) noise belongs to the clouds (and so that thunder exists) cf. 93a36-b3, 7-14. If the original account is to play this role, it cannot itself involve knowledge of the existence of the kind; for that would be to assume at the outset that there is a middle term.² Nor can it require knowledge of the kind's essence; for if it did this would invoke features which could not be proved (in the approved II 8 system) from an essence-involving middle term.³ For these reasons, the original account of what a term means is, in these chapters, neither existence-assuming nor essence-involving. For the point of possessing such an account is to enable one to establish — at the second stage — that the kind exists, and, at the third stage, what the relevant essence is. The first stage gives one some of the materials to proceed to answer these questions.

If Aristotle does adopt a 3-stage account of scientific inquiry, several questions become pressing:

- (a) what information is needed at stage I as a necessary preliminary to discover the existence and essence of the kind involved?
- (b) what information is required at stage II in order to possess sufficient information to know that the object or kind exists?
- (c) what is the connection between the type of information acquired at stage I and II and the complete definition of (e.g.) thunder discovered at the conclusion of scientific investigation into its essence? (i.e. between pre- and post- explanatory accounts of 'thunder').

These questions raise, in an acute form, several even more fundamental issues. How is it, in Aristotle's theory, that one obtains at stage I information which is — on occasion — about kinds, even when one does not know that these kinds exist or even that they are genuine kinds (with their own essences)? How is it that what is discovered to exist at stage II — on the basis of this information — can be, on occasion, kinds with given essences? That is, how is it that stages I and II are connected, at least in some cases successfully, with the final stage of enquiry?

In the present paper, my focus will be on questions (b) and (c): what

(2) Contrast Robert Bolton's claims: *P.R.* 1976. Essentialism and Semantic Theory in Aristotle.

(3) Contrast Terry Irwin's views: Aristotle's Concept of Signification in *Language and Logos* (ed.) Schofield and Nussbaum C.U.P. 1982. I assume that the role of the original account (in certain cases) is to provide a potential conclusion for such a proof (cf. *Post. An.* 93b38-94a2). As such, it will involve the terms to be proved to belong together (*viz.* the A and C terms), and not the terms which prove that this is so (*viz.* the B term).

information is required to know that a kind exists? How is this information connected with the completed definition achieved at stage III? So, this paper will remain neutral on question (a), and on the larger issues of Aristotle's view of meaning.⁴ Thus, if Aristotle had held that one could not know the meaning of (e.g.) 'gold' without knowing that gold exists — and so did not separate stages I and II, he would still have needed to determine what is required to know that a kind exists. This paper addresses this latter problem.

Aristotle's remarks on stage II — the existence issue — in the *Analytics* are elusive. In *Post. II.2* he writes:

'whenever we seek the fact or if it is *simpliciter*, we seek whether there is or is not a middle term for it'. (89b37-8)

Or again,

'The middle term is the explanation (*aition*), and in all cases this is sought. Is it eclipsed? Is there some explanation or not? When we know that there is *some* explanation, we seek what it is?' (90a6-9)

For while in these passages Aristotle boldly asserts that to know that (e.g.) the moon is eclipsed requires that one knows that there is *some* explanation for this occurrence, he does not specify what is needed to achieve this stage. Does one, for example, need to know some actual feature which figures in the proper causal explanation to meet this requirement? Or does one merely need to know that there is some such feature? And how is this latter state achieved?⁵

Aristotle's examples are not, in themselves, very illuminating on this issue. Thus, in *II.8* he writes:

'we discover (in some cases) the fact, but not the reason 'Why?'. Let moon be C, eclipse be A, not being able to cast a shadow during full moon with nothing evident in between, B. Then if B belongs to C, and A belongs to B, then we know that the moon is eclipsed but not yet why; we know that an eclipse exists, but do not know what it is'. (93a35-b3)

But is the B-term (inability to cast a shadow during full moon with nothing evident in between) one which points to a real state of the moon (*viz* that state, which makes it incapable of casting a shadow), and so to a genuine causal feature which explains the eclipse? Or does it merely indicate the absence of shadows caused by the moon under certain conditions — and so point to some feature of the environment present when eclipses occur which is not itself a cause of the eclipse but rather an

effect? Either way, it does not show in any detail what needs to be established to discover that eclipses exist.

Aristotle's remarks on knowing the fact in *Post. An. I.13* serve to raise further difficulties, rather than to assist in resolving those already mentioned. In this chapter, he gives several examples of knowing the fact (knowing *to holi*: 78a22) without knowing the reason why. In some, one knows the fact (e.g. that the planets are near) because one knows that the planets are not twinkling. Here, one grasps the fact alone since it is not because planets do not twinkle that they are near, but rather because they are near that they do not twinkle. In these cases, at least, one grasps as the middle term an effect of the planets being near which is *counterpredicable* with the cause. (78a28-30)⁶ But this is not so in all cases. Thus, Aristotle writes:

'In cases where the middle terms do *not* convert and the non-explanatory is more familiar, the fact is proved but not the reason why'. (78b11-14)

In these cases, one has a demonstration of the following form:

$$\begin{array}{l} A \Phi \text{ all } B \\ B \Phi \text{ all } C \\ \hline A \Phi \text{ all } C \end{array}$$

in which B states a non-explanatory but more familiar property, and B is not counterpredicable with the A-term. Further, $A \Phi \text{ all } C$ cannot give an explanation of why:

$$B \Phi \text{ all } C$$

For if it did

$$A \Phi \text{ all } C$$

and

$$B \Phi \text{ all } A$$

(6) In this case, the relevant syllogisms appear to be the following:

I. THE FACT

A		B
Being near	Φ	all non twinklers
B		C
Non twinkling	Φ	all planets
Being near	Φ	all planets
A		C

II. THE REASON WHY

B		A
Non-twinkling	Φ	all which are near
A		C
Being near	Φ	all planets
Non-twinkling	Φ	all planets
B		C

A and B are convertible, but A (or B) is not convertible with C (as specified here). This is a general problem for C-terms in several of Aristotle's basic examples (e.g.: the moon: 93a30, the clouds 93b10 in *Post. An. II.8*). It requires further discussion to establish whether Aristotle thought that the C-term should in these cases be further specified (*i.e.* planets in certain conditions), or alternatively did not demand counterpredication of all three terms in demonstrative syllogisms. 'Demonstration' is used (rather surprisingly) to describe both syllogisms in this context (78a36) and in *Post. An. 98b20* [By 'Φ' mean *belong to*].

(4) I discuss these in outline in *Aristotle on Meaning and Natural Kinds*. But these topics require further extended treatment which I intend to offer elsewhere.

(5) This issue is raised in a characteristically sharp form in John Ackrill's paper: Aristotle's Theory of Definition: Some Questions on *Posterior Analytics* II. 8-10 in *Aristotle on Science* ed. E. Berti. Padova 1981.

would be the premisses, and *A* would convert with *B* (as in the first case). But if so, the connection between demonstration of the fact and knowing why is further weakened in this case: for the explanation is not cited at all. But is it not clear in this chapter what type of example Aristotle is considering at this point.

One possible example of this structure might be given (again somewhat elliptically) at *Post. An.* 99a30-35. The case runs as follows:

<i>A</i>	Φ	all	<i>B</i>
<i>B</i>	Φ	all	<i>C</i>
<i>A</i>	Φ	all	<i>C</i>

A belongs to all *B*, but *B* need not be a primitive universal which is counterpredicable with *A*. *B* belongs to all *C* (e.g. a very specific class), so *A* belongs to all *C*. An example might be: *A*: being broad leafed, *B* being a green leaf shedder, *C* being a vine. In this case, being broad leafed cannot explain why all *vines* shed their leaves since the *A*-term extends further than vines to other trees. Thus, *A* may be an explanatory term, provided that it is not explanatory of why *B* Φ all *C*, but rather of why *B* Φ all *C*, *D* and *E*.⁷ In this syllogism the relevant middle term (*B*) does not convert with either the *A*- or *C*-terms.

Aristotle's fourth example in *Post. An.* I.13 is somewhat similar. In this case too there is a demonstration of the fact but not of the cause, because the middle-term (being an animal) does not convert with either of the other terms (being a breather, being a non-wall). So although one can establish the fact that walls do not breathe on the basis of two premisses: all things that breathe are animals, and no wall is an animal, one cannot establish that walls fail to breathe because they are non-animals (assuming that some animals also fail to breathe).

The cases in *Post. An.* I.13 are, as will be clear, varied and non-homogeneous. In some, counterpredication is required to establish the fact, but this is not so in all.⁸ Nor are all the syllogisms of the same form. So what unifies this class of cases? Does one in each case know that there is an explanation? How is this knowledge generated? What is the connexion between these cases and the requirement for explanation in *Post. An.* II.2? The *Analytics* leaves these issues unclear and, it appears, unresolved.

In *Post. An.* II.8 Aristotle gives further examples of the type of

(7) In this construal, the *A*-term is explanatory, but not of *B* Φ all *C*. Hence there is no counterpredication. The final set of cases discussed in this chapter (78b13 ff) then will be the only ones where a cause is not mentioned at all. For a contrasting view, see Barnes: *Commentary on Posterior Analytics* p. 150.

(8) This is important in considering the *problemata* analysed in *Post. An.* II.14. See note below.

knowledge required to know non-incidentally that a phenomenon or kind exists:

"As to whether it is, sometimes we grasp this incidentally, and sometimes through grasping something of the thing itself — e.g. with respect to thunder, that it is a given type of noise in the clouds, with respect to eclipse, that it is a given type of deprivation of light, with respect to man that he is a certain type of animal..." (93a21-4)

This passage has many difficulties.⁹ But it is clear that in some cases grasp of the *genus* (animal) and *differentia* (a certain type of...) is, at least, necessary to grasp the existence of man. However, this remark is only illuminating if we already know how the relevant *genera* and *differentiae* are fixed and how they are understood to be so fixed. For if we knew this, we might at least know something of how the existence of kinds such as *man* is established. Unfortunately in this passage, Aristotle simply assumes that the relevant *genera* and *species* have been fixed, and does not say how this has been done.

In *Post. An.* II.13 also (96b25-97a6, 97a23-28) Aristotle seems to assume that the *genera* and appropriate *differentiae* have already been fixed, and then focuses his attention on their proper ordering.¹⁰ Similarly in II.14, Aristotle's method is this: grasp the *genus* (e.g. animal) and see whatever belongs to that *genus* (98a3-4). This allows for the problem to be correctly formulated as (e.g.):

Why does *F* (something which belongs to all animals) belong to all animals? The relevant next step is to note whatever follows from the next of the divisions down: e.g. bird (*G*). For this allows for a further problem:

Why does *G* belong to all birds?

This method forces upon us the correct formulation of problems. 'Why does *F* belong to birds?' is not a proper problem since *being F* belongs to birds, only because birds are animals. Thus it is clear that the point of introducing this structure is to ask questions at the right level for *apodeictic proof*: to see what belongs to what non-incidentally, and what incidentally qua subspecies of a *genus* to which it belongs essentially.

(9) I have discussed some of them in *Aristotle on Meaning and Natural Kinds*. One major problem is whether 'grasping something of the thing itself' is a necessary or sufficient condition for knowing that the phenomenon exists non-incidentally. I intend to discuss this issue — which requires a detailed analysis of the lines 93a25-35 — in detail elsewhere.

(10) These passages require further detailed analysis. In them (e.g. 96b31-5), it seems that Aristotle assumes that at each level *differentiae* will divide *genera* (or sub-*genera*) to form two further genuine kinds by pointing to features which are themselves explained by the essence of the new kind. But this assumption rests on a view about what type of properties are 'differentiating' ones, which is not at all clarified in these passages.

The basis for this method rests on a prior grasp of what counts as a genus and its subdivisions in appropriate order (98a2-4). Of such a genus with its subdivisions thus ordered one can ask: does F belong essentially to genus or subdivision, as the correct basis for setting up the problem of "Why?". It is not that one is using the fact that F's belong to all A's to fix a genus or sub-species. It is rather the other way about: one begins with a grasp of genus and sub-species and then lines the predicates up to them essentially. One is using a set order of genus and sub-species (divisions) to determine which predicates belong to what essentially. One is not in this context using the issue of which predicate belongs to what essentially to fix genus and sub-species. This structure seems particularly clear in 98a13-19. Here Aristotle writes:

'we must extract a common property and ask what (sc. qualities) it follows, and what qualities follow it: e.g. having a manyplies and lacking incisors follows having horns. Again we should enquire to what animals having horns belongs. For it will be clear why having a manyplies belongs to them: because they have horns.'

In this passage, Aristotle (it seems) asks three questions:

- (i) what properties does (e.g.) having horns follow?
- (ii) what properties follow this property?
- (iii) what objects have horns?

(iii) should be different from (i) — as signalled by 'Again...' in the text. If so, (iii) should be concerned with types of animal, not properties [as (i) must be if it is to balance (ii)]. In, (iii), Aristotle is assuming that there are genera or species of animal which are horned, but which lack *one* common name (like 'bird': 98a7). These genera or species might be described by a phrase (wingless quadruped), or by several names. But they will not be picked out only by the phrase 'horned animals'. For in that case, the answer to (iii) would be trivial. There is no evidence for taking 'being horned' as a genus in this passage. Aristotle is depending on *genera* and species marked out by other means in this context also.¹¹

(II) Aristotle is envisaging three stages:

- (a) establish $\forall x [Gx \rightarrow Fx]$, where 'Fx' means x is horned;
- (b) establish $\forall x [Fx \rightarrow Hx]$, where 'Hx' means x has manyplies;

and finally

- (c) What animals have F?

An answer to (c) might be: type A (goats). But while this requires that $\forall x [Ax \rightarrow Fx]$, it does not require that $\forall [Fx \rightarrow Ax]$. Goats might be *one* of the kinds which are F and not the class of animals all and only which have F. (e.g. 99a32-5). If so, there is no essential use of commensurate universals or counterpredication in this passage. Similarly in 99b5 ff, while all birds may have a given property, possession of this property need not be *confined* to birds (e.g. possession of a gut of a given kind) — provided that not *all* animals possess a gut of this kind (cf. *Hist. Anim.* II.17: cf. 508b14-17). It is not required that the universals at this stage belong exclusively to birds (cf.

In this way II.13 and II.14 are closely connected. Aristotle says that division is useful for pursuit of what a thing is (96b26-28), but the uses he envisages presuppose that one already grasps the genus (96b36-37), within which one marks out further distinctions in a systematic way. While division may be of help in introducing the latter distinctions in an orderly way, Aristotle does not suggest that division is useful in fixing what is essential. For he writes:

"To establish a definition through divisions, one must aim for three things — getting what is predicated in what the thing is, ordering them as first or second, and ensuring that these are all there are." (97a24-26)

The first of these involves establishing 'things through the kind': *i.e.* assembling those properties which are essential properties of the kind — and this seems independent of the method of division. That enters at a further stage provided that all the definitional elements already introduced can be uniquely arranged in a descending order. But the process of division here is just a way of arranging definitional predicates. It presupposes (and does not supply) an account of what the definitional predicates are. Thus, both II.13 and II.14 depend on an already-fixed account of what *genus* and defining properties are.

What is to count as a genus is also presupposed in Aristotle's critical discussion of division in the *Parts of Animals*. I. His criticisms hinge on two points.

(a) Division by itself does not show what is properly taken as a *genus*. If we divide in certain ways, then we mistakenly cut across genuine natural kinds (642b10-20), divide by essential accidents not by things that are in the essence (643a27-32) or divide by the wrong things/features (643a35-b6). In these cases division leads to inaccurate results because it does not rest on a genuine account of what naturally belong to the *genus* or *essence* of a phenomena or kind in question. But if so, an account of the genus and essential properties is presupposed, and not established by division.

(b) Correct division must be by multiple, simultaneous differentiae (642b21, 643b9), where relevant differentiae are applied to the genus simultaneously. Both of these points rest on the claim (already familiar from *Post. An.* II.13) that division rests on genera already established. It does not establish what the genera are. Nor does it by itself determine which the species, or relevant differentiae are.

99a32-5), but some could apply to (e.g.) fish as well. I doubt whether the correct formulation of problems in II.14 requires counterpredication or commensurate universals. These features enter at a further stage (cf. 99a32-6) where one reaches the end of the explanatory project. Thus, 'why do all birds have a gut of a given kind? might be an acceptable problem, even if all fish also had such a gut.

If we knew, in given cases, what the genera and species were, we would have at least the basis for establishing the existence of a given kind. But Aristotle seems to presuppose these answers in both the *Analytics* and in this section of the *Parts of Animals*. We are no wiser as to how to establish the existence of kinds at the end of them.

So there are two major questions left unanswered in these discussions:

- (a) What is required to *establish* the existence of a kind?
- (b) How are kinds to be *differentiated* — some as genera, some as species?

These questions are, of course, related. To establish the existence of a kind is to establish the existence of either a genus or a species. To provide successful differentiations into genuine kinds is to establish their existence. However, in the highly abstract discussion of the *Analytics*, these issues are mooted rather than resolved. If they are tackled at all, it is in Aristotle's detailed discussions in the Biological Works. To these we should now turn.

II. THE INPUT OF THE BIOLOGICAL WORKS

In *Parts of Animals* I.4., Aristotle is concerned with deciding which of two methods to follow in describing the properties of genera and species. One method consists in studying each indivisible species separately (644a29-644b1). Aristotle rejects this on the basis that it is 'long-winded', making one describe the same attribute time and time again as they are common attributes of many species. He continues:

"So perhaps the right procedure is this: (a) so far as concerns the attributes of those groups (*genera*) which have been correctly marked off by common usage — *groups which possess one common nature apiece and contain in themselves species not far removed from one another (I mean birds, fishes and any other group which though it lacks a name yet contains species generically similar)* — to describe the common attributes of the group all together; and (b) with regard to those animals which are not covered by this, to describe the attributes of each by themselves; e.g. those of man, and of any other such species." (644b1-9)

The passage contains the following thought. Certain genera have been correctly marked out by common usage: those that (i) possess one common nature, and (ii) contain species not far removed from one another. It appears that — in this passage — one genus will be established if and only if it contains (i) a distinctive common nature and (ii) species not far removed from one another.

This passage, however, is also elusive. It does not say clearly what constitutes one distinctive common nature. Nor does it advance very

far in determining under what conditions species are not far removed from one another. Aristotle does indeed say that:

'it is practically by *resemblance* of the shape of their parts, or of their whole body, that the groups are marked off from one another — as groups of birds, fishes, cephalopods, testacea' (644b10-12),

and further notes that within these groups (*genera*), the parts differ only by '*the more or the less*' — e.g. by being larger or smaller, softer or harder (644b13-15; cf. 644a15-25). But these remarks also are under-specified. Aristotle does not make it clear whether it is difference in shape of parts that *constitutes* (in virtually all cases) difference in nature, or whether different natures marked out on different criteria do — in general — in fact have differently shaped parts. At the end of *Parl. Anim.* I.5 Aristotle notes that the parts of the body 'are for the sake of some action' (645b16-17) and exist for the sake of their natural function (b19-20). Relevant actions include generation, growth, copulation, waking, sleep, locomotion (*ibid.* b35 ff). Is it these functions that define similarity and difference in parts of animals independently of the shape of the parts, so that two parts in different animals may be the same even though they have differing shapes provided that they play the same functional role in similarly organised structures? Or is it shape that is basic, so that major differences in shape constitute difference in parts irrespective of similarity in functional roles? The *Parts of Animals* raises, rather than resolves these issues.¹² Aristotle does not say which of these features are constitutive of having 'a common nature' — or which are 'essential attributes' of a given group of animals (645b1-3).

At the beginning of *Parl. Anim.* II. Aristotle refers us back to the *History of Animals* (646a8-10). And it is there that Aristotle focuses most insistently on these issues. Thus, in *Hist. Anim.* 491a5-10, he writes:

"Our goal is to establish first the different that exist and the properties that belong to them all."

which he takes to be the task of the *historia*.¹³ This suggests that in these writings he is engaged in marking out the genera which are, in reality, different from each other (as in the immediately preceding

(12) Similar issues infect Aristotle's treatment of the 'the more and the less'. Do organisms' parts differ by 'the more and the less' when they subserve similar functions but do so in a 'shape-wise' different way? Or do they differ in this way when they are 'shape-wise' similar enough, even when they subserve somewhat different functions. The remarks in *Parl. Anim.* I.4 leave these issues unresolved.

(13) In 491a8-10, Aristotle is not merely trying to grasp any feature which distinguishes animals — for then why separate the existing differences from those which belong to each animal? This shows that in the *Hist. Anim.* he is engaging in a taxonomic investigation, even if he is not aiming at a complete taxonomy of all the species that there are.

section of *Hist. Anim.* I.6) and then in grasping what properties belong to each member of a genus thus marked out.¹⁴ So we may address to these writings the following questions:

(a) does Aristotle here succeed in marking out the notion of a *common nature* required to separate differing genera of animals?

(b) does Aristotle succeed in marking out (in outline) the basis for species-differentiation within a genus?

Positive answers to (a) and (b) would assist us in filling the *lacunae* spotted in the *Analytics*:

- (i) what determines what the relevant *genera* and *species* are?
- (ii) what is involved in establishing the fact or existence of a genus or species?

For if Aristotle's use of the idea of *common nature* is important for his investigations, this may provide his basis for establishing the existence of *genera* and *species*. Thus, to know that a genus or species exists is to know that it possesses a common nature of some type (possibly so far unspecified). But to know this is to know that there is a cause (*viz.* its common nature) which explains why (e.g.) gold or fish exists, or possesses certain properties — even if we do not know what the cause is. To know that there is a nature guarantees the existence of a kind even before we grasp what that nature is. It points to the existence of the unifying principle or nature required if there to be a genus or species whose existence is established at the second stage of the enquiry.

My main aim is to see how far the *Historia Animalium* provides insight into the dark places left in the *Analytics* discussion. But this can only be achieved if the reading to be offered of the *Historia* makes sense of Aristotle's argumentative structure and deployment of data in this work. So my subsidiary aim is to suggest an outline for understanding Aristotle's project in certain central parts of the *Historia*.

III. HISTORIA ANIMALIUM

In *Hist. Anim.* I.6. Aristotle lists the seven main groups (*genera*) of animals: birds, fishes, cetacea (all of these are blooded), hard-shelled fish, soft-shelled animals, 'softies' (types of calamary) and insects (490b7-14)

(14) See *Part. Anim.* 645b1-3 'our task is to distinguish the properties (*sumbebekota*) which belong to each group. I mean the essential attributes which belong to all the animals...' It seems that in 491a10-11, the properties (*sumbebekota*) should be of this type — *viz.* the object of possible demonstrations (cf. *Pr. An.* 46a24-7), and not merely accidental properties.

— where the last four are bloodless. How did Aristotle arrive at this classification? Why did he exclude certain other candidates as genera or great genera? (490b15-491a6)

Aristotle's earlier discussion in *Hist. Anim.* I.1-5 has laid the foundation for these claims. Birds have been marked out as feathered fliers (490a6-7, 12-13), fish are as gilled, finned and footless swimmers (489b22-6). Cetacea are also swimmers, but lack gills and instead have a blow-hole (489b2). Insects are fliers with membranous wings (490a9-11) and by contrast with other fliers are bloodless. The 'softies' (*cephalopods*) are swimmers, possessed of feet and fins (490a1-3). The soft-shelled animals (*crustacea*) are all capable of locomotion (487b16-18 — whether by swimming or walkings), while many types of hard-shelled animals (*testacea*) are stationary (487b15), and take in neither water nor air (487a25-6).

Aristotle, it appears, has provided a justification for treating these *genera* as correctly marked out by common usage. This has been done by showing how these kinds exhibit genuine differences in the following respects:

- (a) *type of locomotion*: walking, flying, swimming;
- (b) *method of breathing*: with lungs, gills, blow-holes;
- (c) *method of eating*: where the animals find their food (487a22-7).

In some of these cases, modes of locomotion are the basic ingredients. Fliers are divided according to their method for doing so (feathers, membranous wings). In others, modes of breathing are basic (gills, blow-holes etc.). But each of these kinds is marked out using basic divisions within the life functions (locomotion, breathing, eating etc.). It appears that it is these affections and actions that provide the basis for Aristotle's classification at this point (cf. *Part. An.* 645b35 ff). To have a common nature is to have a distinctive way of fulfilling at least one of the basic life functions.

This claim becomes clearer when Aristotle considers cases of groupings which fail to yield *great genera*. *Wingless quadruped* is briefly canvassed as a possibility in 490b19-20, but not used elsewhere as a genus. By contrast, viviparous quadruped and oviparous quadrupeds are introduced and retained as relevant genera, although neither are great genera. Why is this? Aristotle notes that wingless quadrupeds would divide into the viviparous and oviparous (490b20-1). These are nameless groups, but so are the immediate sub-divisions within the genera of viviparous quadruped (490b32-3). The explanation seems rather to be that if one had a genus such as wingless quadruped, the species within this genus would not be very similar (*Part. An.* 644b4-5) in a certain crucial respect: method of reproduction. And from this difference, other important differences follow — with respect to hair and horns (490b21-3).

In this example, Aristotle is relying on two ideas. If one has a *genus*, the species which comprise it should perform basic life functions in a basically similar way (e.g. reproduction). Further difference in mode of reproduction is sufficient to show that there are different genera in the case of quadrupeds. Both show that Aristotle is concerned to secure his favoured genera on the basis of a unified *common nature* — in which shared ways of performing certain basic functions are of central importance (locomotion and reproduction, in this case).¹⁵ In the case of a unified genus there is a distinctive way of moving, reproducing, feeding and breathing. Difference with respect of one of these life functions undermines the unity of the genus. The idea of a *common nature* rests on the thought of one organized collection of methods of moving, reproducing, feeding and breathing. A powerful theory of what constitutes a common nature is at work in selecting the great genera in I.6, and in ruling out other possible cases.

The theory is at work elsewhere in the *Historia*. It is a recurrent feature of this work that Aristotle attempts to line up kinds of animals with given features in structures of the following form:

'As many as are X, some/all/none are y.'¹⁶

In discussing the instrumental parts of blooded animals, Aristotle take the following cases as standing in the X-place (505b25-523a27).

viviparous quadrupeds (505b32, 506b26);
oviparous quadrupeds (505b35, 506b26);
viviparous quadrupeds with horns and do not have teeth in both jaws (507a34);
footless not internally viviparous (509b6);
footed viviparous (510a13-14, 517b2-3);
footless animals that are externally viviparous though internally oviparous (511a4, 521b25);
footed ovipara (517b4-5);
blooded animals that are internally and externally viviparous (520b27, 521b22).

In these cases, Aristotle is again using features relevant to locomotion and reproduction as the basis for dividing up types of animals. Subsequently when he divides the kinds *further* than the genera marked out in *Hisl. An.* I.6. he frequently does so by dividing by

(15) Why are serpents not a 'great genus'? Is it because this 'genus' too cuts across animals with different means of reproduction (oviparous/viviparous: 490b24-27), where the *species* are too different from each other? Aristotle leaves this point in the air in I.6, and proceeds later to treat serpents in certain respects like other oviparous land-animals (508a9-12), although he notes that serpents are divided as to their habitat (505b6-10).

(16) This point is clearly and correctly emphasized in Jim Lennox's paper: *Divide and Explain. The Posterior Analytics In Practice in Philosophical Issues in Aristotle's Biology* (ed.) Gotthelf and Lennox C.U.P. 1987.

means of the ways in which the animals reproduce (internally, externally, viviparous etc.). He only goes further in 507a34 by invoking a further sub-division within the class of viviparous quadrupeds: those that have horns but lack teeth in both jaws. But this further demarcation is forced on him since at this point he is focusing on differences in types of stomach. Not all of Aristotle's X-places are filled by types of animals marked out using features relevant to generation and locomotion in this section. Other cases are:

blooded animals (506a6-14);
animals that take in air (506a2);
animals that have kidneys and bladders (506b32).

But the latter two examples are dependent on the subject-matter in the passage under discussion: oesophagus and windpipe in the first, kidney and bladder in the second. 'Blooded' is somewhat different and is used quite widely; but this seems to refer back to the first three great genera (fish, birds, cetacea) mentioned in *Hisl. Anim.* I.6, and to the other cases of blooded animals later adduced (e.g. man: cf. 505b29-32). The basis for differentiation remains organized natures with distinctive means of reproduction and locomotion in these passages.¹⁷ It seems that throughout these sections Aristotle's demarcations rest on classifications dependent, in the main, on differing ways of fulfilling the basic functions of reproducing, moving, breathing, and growth (*Part. An.* 645b33-5). It is these which constitute the genera — whether great or less — marked out by differing types of organization for fulfilling these functions.

Aristotle's intuitions about *common nature* depend on his view of the basicness of locomotion, breathing and reproduction in the study of animals. On this foundation, he has good grounds for marking out the great *genera* of I.6 — in terms of differing ways of moving, breathing or reproducing. Once he has marked out a common nature in this way, he is able to mark out differing sub-kinds in a structured way. Fish are gilled, finned swimmers (489b24-5). He is then able to use these differentiae of fish to divide the genus further:

- (a) 4 - finned *vs* 2 - finned *vs* no-finned: 504b27-35;
- (b) covered *vs* non-covered gills (505a1-2);
- (c) single *vs* double gills (505a8-10);
- (d) few *vs* many gills (505a 10-12);

and thus to separate several major species within the genus of fish such as selachia (504b36), muraena (504b34, cf. 489b24-6), eels (504b27-30 cf.

(17) A similar story is present in Aristotle's discussion of miscellaneous parts (533a1-558b6). There, too, the X-places are filled by e.g. four-footed ovipara (536a4), footed, blooded, and non-ovipara (538a21), man, footed, vivipara, blooded ovipara (533a1), blooded oviparous quadrupeds (557b32).

489b24-6), as well as other smaller species (such as the mullet, parrot-wrasse, perch, rainbow-wrasse, carp, dog-fish, sword-fish, tape-fish, fishing-frog — all discussed in *Hist. Anim.* II.13).

All fish have other features in common also (in Aristotle's account). All are blooded (505b2-3), all have a bladder (506b4) — although this may be differently placed in different fish (*Hist. Anim.* II.15). All have a gut of a given type — a feature they share with birds (508b14), although they differ from one another in the number they possess (508b15-25). Aristotle uses these differentiae to mark out varieties of fish (at a fairly specific level: e.g. angel-fish, skate, pipe-fish, goby, burbot etc.). But these are all varieties of *fish* because they carry out similar functions (nutrition of a given type) in similar ways, and all possess the differentiae of fish (they are either gilled or finned swimmers).

Through employing these intuitions about 'common nature', Aristotle is able to vindicate the popular assumption that fish are *one* genus of animal — with similarity in function and in structural features related to those functions. Against this background, he is able to mark out major differences between fish in other respects: some, the scaley fish, are oviparous, others viviparous (505b2-4) — for instance, the *selachia*. Indeed, he defines the *selachia* as footless creatures which have gills and are viviparous (511a5-7)¹⁸ *Selachia* have distinctive sexual differentiae (538a29), bone structure, and reproduce in a distinctive manner (540b5 ff, 564b15 ff). Thus, Aristotle is relying on the importance of the soul-function of reproduction to distinguish lower-level types of fish — where all are varieties of *fish* because all are blooded and either breathe or move in the way distinctive of fish. There is a determinate enough *common nature* of this type to unify the class. Indeed what it is to have a common nature is to have one organised mode of performing certain of these basic soul functions.

Once this common nature is established, Aristotle is able to differentiate between fish in terms of how they perform other soul-functions: generation (III) perceiving, hearing, sleeping (IV), reproducing (V, VI), eating (VIII), migrating (VIII.12 ff), hibernation (VIII.15), flourishing (VIII.19), illness (VIII.20), adaptation to their environment (IX.37). Of these, procreation and eating are the most basic (in Aristotle's view):

'One part of the life of animals consists in actions concerning procreation; another in actions concerning food. For it is one these two activities that interests and life of all are fixed'.

(18) What happens to the fishing frog (505b2)? It seems to remain submerged in the subsequent discussion.

And elsewhere he notes:

'The habits of animals are all concerned with breeding and rearing of young, or with obtaining food'. These habits are modified so as to suit cold and heat, and the variations of seasons'. (596b21-24)

In discussing these activities, Aristotle often begins his account by saying what all fish have in common: they all lack testacles (509b3, 25), none have breasts or milk (521b25-6), all lack visible sense-organs (533a30), all sleep (537a1), and all feed on spawn (591a6). But then he proceeds to note that differing kinds of fish perform these functions differently.

The case of eating in *Hist. Anim.* VIII.1-12 is instructive of Aristotle's method, and I will again focus on his treatment of fish.¹⁹ In VIII.2. Aristotle in general is concerned to note differences in eating patterns between the different types of fish he has already marked out on separate grounds such as:

- (a) types of gill: grey mullet, scarus, selachians, dentex²⁰;
- (b) types of fin: conger, muraena, bass, gilt-head, bass, eels²¹;
- (c) types of gut or gall: amia, red mullets, cephalus, goby²²;
- (d) types of skin: tunny²³;
- (e) types of breeding or spawning pattern: sea-perch, saupe, physics, rock fish, mackerel, sargue, channa.²⁴

In these distinctions, modes of breathing, moving, digesting and reproducing play the central role. Aristotle, in nearly all cases, is mapping distinctive ways of finding food on to types of fish which he has

(19) In VIII. 1-12, Aristotle is concerned to map differing ways of obtaining food on to his favoured genera (fish, birds, serpents and other scaly animals, viviparous, quadrupeds, and insects), and their sub-species. Thus, in the remainder of VIII. 2., Aristotle operates with the following demarcations of aquatic animals:

- 590a18: hard-shelled animals (*testacea*) that are incapable of motion;
- 590b1 ff: mobile shell-fish;
- 590b10 ff: crustaceans;
- 590b30 ff: soft shelled animals;
- 591a1 ff: octopus;
- 591a6 ff: fish.

He then discerns their differing ways of finding food — as was to be expected given their differing natures — and marks further differences within the respective genera.

(20) Grey mullet (591a18 cf. 504b32), scarus (591a14 cf. 489b26-7), selachians (591a10 cf. 489b24-6), dentex (591a11, 505a16).

(21) Conger (591a10, cf. 489b26), muraena (591a11 cf. 489b24-6), bass (591a11, cf. 489b26) gilt-head (591b10 cf. 489b26), eels (591a18, b31, cf. 505a16).

(22) Amia (591a10, cf. 506b13), red mullet (591a12, cf. 508b17) goby (591b14, cf. 508b17).

(23) Tunny (591a11, cf. 505a27).

(24) Saupe (591a15, cf. 543a8), physics (591b13 cf. 567b20), rock fish (591b14, cf. 543a5), sargue (591b19, cf. 543a7) channa (591a11 cf. 538a21), sea-perch (591a11, cf. 543b1).

already distinguished in terms of other soul-functions. Thus, he is confirming his earlier classification by showing how these differences are related to other differences with respect to eating. The only three (clear) cases of fish species added in VIII.2 are the dascyllus (591a14) melanurus (591a15) and the peraeas (a24). All others have been already marked out in terms of their other soul-functions. Indeed this is the general pattern in Aristotle's discussion of migration, hibernation, flourishing and adaptation. In the overwhelming majority of cases, the types of fish attributed different kinds of (e.g.) migratory pattern have been marked out using the basic distinctions already mentioned. While he is prepared to add four further types of fish to his list at this point (e.g. black bream, 598a10; weaver, 598a12; braize 598a13; sea cuckoo (598a14), the remaining twenty-four have already been distinguished on other grounds. In these cases Aristotle is separating distinct sub-species of fish in virtue of their basic natures — modes of moving, breathing, digesting and reproducing, while occasionally underwriting further groups which differ in eating or migrating pattern. The theory of soul-function is at work both directing his enquiry and underwriting his vindication of popular claims about differing types of fish.

In the cases so far considered the theory of soul-function is used to differentiate the genus of fish, and to mark out further differences within this genus. But elsewhere in *Hist. Anim.* VIII. it is used to separate different types of *aquatic* animal. Some live and feed in water, take in water and emit it (e.g. fish), while others live and feed in water but take in air not water and breed away from water (e.g. otter, beaver, crocodile). (487a18-20) Some again obtain their food in water, but take in neither water nor air (e.g. shellfish, sea-anemones: cf. 487a23-25). In these cases, mode of breathing and location of food are used to distinguish different types of water-animal. Aristotle then links them to an extent by commenting that no water-animal which takes in seawater gets its food from land. (487b3-5) In this passage, breathing and mode of nutrition play a decisive role in separating out animals which share the same habitat, and in marking out different ways of *being aquatic*.

In his subsequent discussion of these animals (*Hist. Anim.* VIII.2.), Aristotle is forced to further refinement in his treatment of the *aquatic* through consideration of the dolphin (589a33-b27, 590a13-18). The dolphin is remarkable and a problematic case because it takes in and discharges water by his blow-hole, and yet also inhales air into his lungs (589b5-6). Thus, the dolphin takes in and emits both water and air, and hence could be classified as both *aquatic* and *terrestrial* (589b7-14). Faced with this problem, Aristotle moves to further define (*prosdiōristeōn*: 589b13) the *aquatic* as follows: some aquatic animals take in water (*via* their gills) for the same purpose as respiration — to cool

their blood; others take in water for the different purpose of obtaining food; and hence do not use water to cool the blood but expel it *via* their blowhole (589b15-18). These animals use air to cool their blood, and hence are *aquatic* in a different way from fish. Difference in breathing distinguishes different ways of being aquatic: one type of animal breathes by taking in water, the other by taking in air (590a14).²⁵ Fish and dolphins, however, take their food from the water, and thus can be distinguished from animals which breathe like fish but obtain their food on dry land (the water-newt: 589b25-8). In these cases, Aristotle is using basic soul functions (breathing, eating and locomotion) to distinguish different ways of *being aquatic*. And this is what one would expect given that he is carrying through his investigation with a robust theory of what is to count as a *common nature*. When animals without a common nature are both characterisable as '*aquatic*', this shows that the latter term needs further definition.²⁶

This pattern of argument suggests that Aristotle in the *Hist. Animalium* is beginning with a set of beliefs about what possessing a *common nature* consists in: being an animal with an organized set of soul-functions involving (typically) locomotion, breathing, reproducing and eating. To establish that a great genus exists involves establishing that there is an organized and distinctive set of soul-functions of this type, where one can see further species as differentiated (in large part) by their differing ways of performing the same set of soul-functions. To establish that a species of genus exists is to establish that there is a nature which performs the set of soul functions of the genus in a sufficiently distinctive manner.²⁷ In both cases, one is grasping that there is a *common nature* involved, even if one has not fully grasped what that nature is: what all the precise soul-functions involved are.

According to this view, Aristotle is not in the *Hist. Anim.* engaged in a wholly *a priori* investigation of the natural world. While his theory of soul-functions is drawn from his psychological works, it is an empirical matter to determine what the relevant genera or species are:

(25) In 590a14-15 Aristotle also adduces the mixture of the body (*Krasis*) as a way of distinguishing different types of *aquatic* animal. This appears to depend on the surrounding medium by which the animal is cooled and the food it takes in (*Gen. Anim.* 767a30 ff). If so, it is determined by features relevant to breathing and food, and so is derivative from these more fundamental categories.

(26) This passage has interesting implications for the study of *dualizers*. It suggests that dolphins dualize only provisionally between *being aquatic* and *being terrestrial*. They do not dualize when the definitions of *being aquatic* are further tightened (589b12 ff). This point is discussed by Robert Parker in his review of G. E. R. Lloyd's: *Science, Folklore and Ideology: Phronesis* 1984 p. 184. See also Herbert Granger's: *Scala Naturae* and the Continuity of Kinds. *Phronesis* 1985.

(27) This is further clarified at stage (111): see below.

what types of organized soul-functions there are.²⁸ But on the other hand his work is not wholly *empiricist* either. He is not fixing a genus merely by collecting a large group of counterpredicable properties, and then using division to establish the species. Rather the weight given to differences in basic soul-functions shows that he is relying on strong background assumptions about what features are relevant to establishing genuine *common natures*. His enquiry is, in effect, the progressively more systematic elucidation of certain controlling concepts of this type which results empirically in differentiation into kinds and sub-kinds.²⁹

It is clear that Aristotle in the *Hist. Animalium* is not aiming at a complete taxonomy of all animals — an exhaustive, hierarchic

(28) Contrast I. During's claim in Aristotle's Method in Biology in *Aristote et les problèmes de méthode* (ed.) S. Mansion p. 218: 'even in his most advanced biological works his reasoning is based on *a priori* principles and book knowledge more than on observation.' And elsewhere 'It does not seem reasonable to characterize his method as empirical' (*loc. cit.*).

(29) I take it that an empiricist reading of the *Historia Animalium*, which saw it as concerned with establishing the existence of kinds and species, would represent Aristotle's method as follows:

stage (I): use counterpredication to establish genera as the locus of many such counterpredictions;

stage (II): divide within such genera using further counterpredication and division to establish species,

On this account, stages (I) and (II) would be innocent of background theoretical assumptions about what constitutes a common nature. I have been arguing against this view by emphasizing the significance given to certain factors as constitutive of a *common nature* throughout Aristotle's discussions of *genera* and *species* (e.g. in the case of fish). Further, even where Aristotle could set up wider genera (e.g. the blooded in *Hist. Anim.* I.6 or the lung-possessor: *Part. Anim.* 669b8-10) using counterpredication, he does not do so when the distinctions cut across his favoured genera with their distinctive common natures. His treatment of being a lung-possessor is especially interesting. Aristotle notes that because there is no common name which applies to those genera which have bloodless lungs, this fact appears in the specification of their essence. Thus, here Aristotle is noting that there is no one genus of (bloodless) lung-possessors in contrast to the case of birds. Rather having lungs of a given type appears in the specification of different genera marked out on other grounds. Counter-predication is not enough to establish a genus. What is needed to do this is the feature which all birds possess and lung-possessors do not: *viz.* a sufficiently rich common nature. Further, once genera have been set-up — such as fish which are all blooded (505b2-3), some are viviparous, some oviparous, some have an oesophagus (II.17), and all have a gut like that of birds (508b14-15). Counter-predication plays a very small role in establishing the *genera* themselves. It is one way amongst many of establishing that there is a common nature. Certain elements in Lennox's recent papers on these topics (*Divide and Explain*: see footnote 16; *Between Data and Demonstration: the Analytics and the Historia Animalium*: 1988. *Science and Philosophy in Classical Greece*) suggest that he advocates an empiricist reading of the *Historia Animalium* (subject to certain qualifications). Lennox's views, however, are subtle and evolving, and I hesitate to represent them as constituting the 'out-and-out' empiricist reading sketched at the beginning of this note.

classification. For his account (as has been frequently remarked) is incomplete in many respects. Nor will all the differentiations he makes turn out to be relevant to the classification of kinds or sub-kinds. Rather what he is seeking to do (on this view) is to show the adequacy of his theory of soul-functions to mark out the differing species of animals — even though he has not himself completed the task itself. The *Historia* is a concealed argument for the centrality of these concepts in establishing the existence of genera and species — even if not all have been actually established by Aristotle's methods in this work. He is giving a blue-print for a successful taxonomy, rather than attempting to complete that taxonomy himself. But he is attempting far more than laying out all the relevant animal differentiae.³⁰

IV. STAGE II AND STAGE III

The assumption of a common nature at stage II embeds an explanatory notion at the pre-(scientific) explanatory stage, which serves two purposes.

(a) It explains why what is grasped at the earliest stages (I and II) by way of genera and species is explicitly connected with stage III. For what is discovered at stage III explains the basis for a *common nature* (e.g. shared teleological goals and shared type of material basis: degree of heat). It is no accident that the genera and species marked out at stage II match those which science explains since the latter will fill out and further explicate the guiding conception of a shared nature already implicit at stage II. If this notion had not been invoked at the second stage, and the genera and species marked out only by counterpredication and division it would have been left unexplained why the pre- and post-scientific classification match each other so nearly. There is no inconsistency in genera and species being determined by the method of counterpredication to which in general

(30) For a contrasting view, see David Balme's Aristotle's use of division and differentiae in *Philosophical Issues in Aristotle's Biology* (ed.) Lennox and Gotthelf p. 80. He argues that 'the role of *Hist. Anim.* is to collect, screen and distinguish, and describe correctly the differentiae requiring explanation'. The basis for this claim is that a) Aristotle did not systematically classify sub-genera, and b) involves within some sub-genera a wide variety of animals. Both these points seem to be correct, but only show that Aristotle had not fully used his taxonomic resources to carry through the classificatory task of discerning what groups of animals there are. They do not indicate that he was engaged in the quite different task of merely collecting animal differentiae. Balme's view, although a healthy reaction against the extreme *a priori* reading offered by During of the *Hist. Anim.*, represents Aristotle as an 'out-and-out' empiricist, untrammelled by any specific theoretical presuppositions in this work.

there corresponds no one explicable nature (e.g. the lung-possessors). If so, there is no reason to believe that pre- and post-scientific classification would match each other as well as they seem to do (in Aristotle's account).

(b) It also explains why authority rests with stage III type considerations in determining the extension of certain concepts; for if it can be shown that there is no common nature informing a class of cases one is constrained to take them as distinct. Thus Aristotle writes in discussing pride:

"If we do not come to one but to two or more accounts, it is clear that what we are seeking is not a single thing but several." (*Post. An.* 97b14-15)

Thus, if there is not one thing common to all proud men, there are distinct types of pride — different things in virtue of which (97b17) proud men are proud. But this suggests that putative difference in internal cause (e.g. indifference to fortune: not brooking dishonour) forces difference in species or genus. But this will only be so if at the earlier stages the genera or species are marked out in such a way that they are dependent on (revisable in the light of) stage III considerations. And this will not be achieved if they are marked out by the empiricist method of *counterpredication and division alone*. For that method gives no ground to accept Stage III considerations as possessing authority concerning correct pre-scientific classification. The assumption of a common nature is precisely what is needed to legitimize reposing authority in discovering the existence of mind with Stage III factors. Since in his discussion of pride Aristotle places authority in taxonomic issues with Stage III factors, he cannot be marking out the pre-scientific divisions in ways which ignore scientific features (as he would have done had he operated only with the highly empiricist counterpredication/division method). Indeed, given Aristotle's reliance on Stage III factors, one would not *expect* his discussions of existence issues in these cases (stage II) to be complete or exhaustive. It is only when the stage III explanatory task is finished that the taxonomic issues involved at stage II can be finally resolved. It is these explanatory considerations which determine (e.g.) what are the lowest levels of animal species (below which one has more/less variation within a species) and the full range of relevant species (as in the case of pride). Given this perspective, the taxonomic incompleteness of the *Historia Animalium* was inevitable. It would not have been possible for Aristotle to have produced a complete taxonomy without considering the basic explanatory questions which he considers in detail only elsewhere (e.g. in *de Partibus* and *de Generatione Animalium*).

On this view, it is sufficient to establish that a kind exists to establish that it has a distinctive nature — even if one does not know in detail what this is. To establish that something has a *distinctive nature*,

it is sufficient to establish either that it has an efficient cause or is an organized structure with one teleological characterization. In both cases one may be unaware of what the relevant cause is. In the biological examples, one would establish the existence of such a structure by showing that there is an animal with a number of distinctive basic soul-functions involving locomotion, nutrition, breathing or reproduction. This is to establish that a relevant differentia belongs to a wider genus in the way required to show that one is confronted with an organized structure. Counterpredication is one way to achieve this result; for it provides evidence that there is an organized nature before one. But what it is to be a common nature is what explains why, in these cases, there is counterpredication of this type. And one knows in the case of animal species and *genera* that such kinds exist when one knows that there is some such organized nature.

Reflexion on Aristotle's method in the biological works serves to illuminate issues left unresolved and obscure in the *Analytics*. It is only there that one sees Aristotle spelling out in some detail answers which show what is required on his view to establish the existence of distinct genera and species. In the biological works, Aristotle does not merely follow a pre-set *Analytics* model of scientific investigation. Rather he is struggling to make that model at once more precise and more powerful.³¹

(31) Earlier versions of this paper were read at the A.P.A. (Western Division) in Los Angeles in 1986 and at the N.E.H. summer school on Aristotle at Durham, New Hampshire 1988. I am especially indebted to Allan Gotthelf and Jim Lennox for many lively and interesting discussions on these issues. Jim Lennox's criticisms of an earlier version of this paper at La Rochelle, together with our daily talks on these topics in the New Hampshire, have played a major role in forcing me to rethink many of the issues in this paper. The paper has evolved considerably through this process, and contains a variety of points which have arisen out of our friendly and collaborative discussions and disagreements. I have also gained from comments of David Balme, John Cooper, David Depew, Geoffrey Lloyd, Terry Irwin, Mario Mignucci and Pierre Pellegrin. However, none of those mentioned agree with all of this paper, and some agree with almost none of it.

NOTES ON DAVID CHARLES ON *HA*

JAMES G. LENNOX

In David Charles' view the second book of the *Posterior Analytics* describes, among other things, three distinguishable stages of inquiry; the end points of these stages are [i] having an account of what the term signifying the purported kind being investigated means [ii] having a grasp that the kind being investigated exists [iii] knowing what the kind is. Unlike certain popular contemporary accounts of meaning, Aristotle's stage [i] is neither essence referring nor existentially committed (where this means "committed to the existence of the 'kind' to which the term answers"). Stage [ii] moves the investigator to the plane of existential commitment; Stage [iii] to that of essential grasp.

There is another side to these stages, according to *Posterior Analytics* II. The scientific investigator also moves from knowing *that* certain predications hold true, to knowing *why* they do. That is, chapters 1 and 2 describe *two* pairs of 'things we seek'. I say 'another side' because if *Posterior Analytics* II does anything, it makes clear that investigations aimed at definitions of natural kinds and investigations aimed at demonstrations of non-essential but necessary predications through definitional identifications are not separate processes of inquiry, but interwoven aspects of the pursuit of scientific understanding.

Areas of Agreement

In 'What is Natural History?' and its close descendant 'Between Data and Demonstration...' ¹, I argued that the *Historia Animalium* is

(1) Forthcoming in *Science and Philosophy in Classical Greece*, ed. A. C. Bowen, Pittsburgh, 1990.

claimed to be, and bears striking resemblances to, a report of the results of what the *Posterior Analytics* calls an inquiry into the 'thats', the explicable predicates that hold true of the various kinds of animals. I did not stress the fact that, given the close connection between the 'if it is/what it is' and the 'that it is/why it is' pair of inquiries, it should also be concerned with establishing the 'existence of kinds', to use Charles' language. I was focused on the kinds of affirmative and negative propositions one finds in the *Historia Animalium*, and in particular on the apparent drive to establish what Allan Gotthelf and I have been calling 'widest class generalizations', commensurately universal one takes the *Posterior Analytics* picture of science seriously. But if the *Posterior Analytics* describes stages of knowledge acquisition which are reflected in Aristotle's biology, then these commensurately universal predications ought also to give us an initial grasp which points us toward what the subjects being investigated are as well. That is, they should count as the product of a David Charles 'Stage II' inquiry.

Areas of Disagreement

The central disagreement between David Charles and me arises over the place and function of 'counter-predication' and 'division', the tools of *Posterior Analytics* II.13-18, in 'Stage II' inquiry. In my papers on this subject, I have argued that a report of the results of such inquiries would be arrived at through a combination of division and 'counter-predication' — these methods would be necessary to establish the basic predications requiring explanation at Stage III. This claim entails, as Charles pointed out in 'Meaning, Natural Kinds and Natural History', that the basic kinds would be fixed *during* such an inquiry, not prior to it, so that my argument seems to imply that *these* are methods which can be used to 'fix' or 'establish the existence of' kinds. There is a serious question about whether 'fixing kinds' is an actual aim of *historia* for Aristotle, or only a consequence of organizing a domain for demonstrative purposes, but for now I want to put that issue aside.

While my papers insist that the 'premise selection' method of *Posterior Analytics* II.14 presupposes already completed divisions (and even refers to works of such which the ancient lists and other lines of evidence give us reason to believe actually existed), they also suggest that relating the terms in these divisions via the method of 'fixing problems' discussed in that chapter — establishing counter-predications — would aid us in establishing the basic predications of the science.

Charles, on the other hand, wants to claim that getting a grasp on the kinds requires embarking on the study with an already established

position on what it is to have a common nature (which he thinks may derive, as G. E. R. Lloyd has often suggested, from the *de Anima* theory of the soul), and then having good evidence that the kind for which you have a signifying account in fact has such a nature (which you can have without knowing what that nature is). Thus on Charles' view, one begins the zoological Stage II inquiry not only with the assumption that animals will fall into groups based on common natures, but with more robust assumptions about the constitution of such common natures.

Let me then summarize the two primary differences between us:

1. Charles is focused on the *HA* as a document the chief aim of which is establishing the existence of natural kinds (with the discovery of co-extensive predications a secondary issue). I on the other hand am inclined to see the opposite emphasis in the *HA*, on co-extensive predication.

2. Charles sees the search for natural kinds as guided by a robust theory of what a common animal nature will consist in, namely an organized set of soul functions. I don't deny that many of the differentiae collected, divided and interrelated in the *HA* are related to soul functions, but that the treatise is organized on these grounds I seriously doubt. I see a more empiricist concept of evidence that a group of animals has a common nature at work in the *HA*. The more empiricist concept is this: locating counter-predications (or commensurately universal predications) aids in identifying the groups that are likely to have common natures.

Relatively Empiricist Common Natures

At the risk of allowing the opposition to define the terms, I will accept Charles designation of my position as 'empiricist'. In my papers, as I mentioned, I was not focused on the issue of 'fixing kinds', but rather on 'fixing *hoti*-predications' as both establishing the explicanda of a domain and as a step toward establishing the explanans. But if the author of the *Historia Animalium* remains committed to the views articulated in *APo.* II then he ought to be concerned *both* with establishing *that* S is P and *that* there are Ss. And these should be intimately connected activities. Furthermore, Charles and I agree that this is a relatively 'theoretical' stage — Aristotle tell us that at this stage, 'aware that there is a cause, we seek what this is'. [*APo.* II.2 90a8-9] The puzzle, of course, is *Meno*-like: how can we know that there is a cause short of knowing the cause? Both Charles and 'the empiricist' have answers to this puzzle — I shall supply an empiricist answer.

David Balme has been suggesting for some time now that the ultimate aim of these works is to grasp the causal relations among differentiae. I would like to suggest that building up a profile of correlations among differentiae will gradually establish the existence of a kind, by providing the evidence *that* there is a *phusis* common to the entities which share these differentiae. The first step in such an activity will be establishing the commensurate (i.e. co-extensive) links among differentiae. This will gradually move you toward a 'profile' of a 'bundle of counter-predicated features', which will be evidence of the existence of a kind, i.e. a group of animals with a common *phusis*, but not evidence of what the kind is. And this is the level of understanding that, on Charles' trichotomy, one has at the completion of Stage II. And one manages this with only division and counter-predication as one's guide.

Where might we start to defend this position? Well, *PA* I.2-4 has an extensive discussion of division during which there is a discussion of what it is for a collection of different animals to make up a *genos*.

PA I.2 critiques the method of single difference divisions in 'the written divisions' for dividing in such a way that groups like Bird and Fish are broken up, part of the kind falling on one side of the division, part on the other. Aristotle insists that it is not just because a collection of animals has been given a single name that they are a *genos*:

Now this likeness has had a name put to it, *Bird*, and another has *Fish*. But others are unnamed, such as the blooded and the bloodless: no one name has been put to either of these. [Balme trans., 642b14-16]

It is a certain likeness among the members of a group that is important, not the mere act of naming. The embedding into language of names for the collection of birds and fish is praised by Aristotle in the next chapter because these names pick out groups of animals which share many differentiae at the same level of generality (*katholou diaphorai* [643b10-13]).

Continuing this theme, chapter 4 begins with the question, why not go for one higher name which designates a kind embracing both the water dwellers and the flyers. 'For there are some *pathē* common even to these' [644a12-16]. Yet Aristotle thinks this would be a mistake. Why?

For as many of the kinds as differ by degree and the more and the less, these have been linked together in one kind, while as many as are analogous have been separated. I mean bird differs from bird by the more or by degree (one is long-feathered, another is short-feathered), while fish differ from bird by analogy (for what is feather in one is scale in the other). But to do this for all is not easy, since most animals are the same by analogy [644a17-23].

When then should we speak 'of some affections in common by kinds'?

...wherever the kinds have been satisfactorily marked off by popular usage and possess both a single nature and forms not far separated in them — bird and fish and any other that is unnamed but like the kind embraces the forms that are in it [644b2-6].

He goes on to say that certain kinds have been marked off by the likenesses of the shapes of the parts and over-all bodily configuration; the *genē* mentioned here are bird, fish, 'the softies' and 'the hard shelled ones'. The last two, referred to by terms derived from adjectives which pick out obvious perceptual features of the things grouped are, like the first two, said to differ only by the more and the less. Nothing so far is said about certain special 'soul functions' as the relevant identities and differences for establishing kinds. Yet this discussion is focused *explicitly* on the philosophical question of how to make the determination of whether two different animals are one in kind. This strikes me as evidence for the empiricist position.

Here then are two conditions for a variety of animals constituting a kind, conditions that will allow you to identify a kind without necessarily having grasped what is most essential in its nature.

1. All members of a kind share many differentiae which are the same at a certain level of generality.

2. These general differentiae are differentiated by continuous variations of their sensible affections, i.e. by degree, more and less.

Significantly, both these conditions on kind identity are explicitly discussed at the very beginning of *HA* I.1 486a22-5, during its introductory discussion of sameness and difference in form, kind, and analogue. The discussion of 'variation in degree' is generally consistent with, though slightly more sophisticated than, that in *PA* I. No claim is made, on the other hand, that only certain soul-function similarities are relevant.

When we have seen this in a group of different animals, this may be sufficient, to use Charles' carefully chosen words, to tell us *that* we have a *genos* with a common nature, though not *what* the common nature is. But how do we recognize animals which constitute groups meeting these conditions? Is it simply intuition? Or might there be a set of methods for doing so in an organized way?

On the view that David Balme has been defending for the last 25 years or so, the focus of *HA* is not on identifying kinds *per se*, but on getting clear how the various differences which the animals display are related to one another. But one can now see how an identification of kinds might arise out of such an enterprise. For if a significant number of different animals differ only in degree with respect to a significant number of parts, activities and habits, so that by abstracting from those variations they are all the same, then one (probably) has a kind. This *may* be what counts as establishing that the kind exists. That is, what

counts as evidence that there is a kind answering to a name or name-like phrase we are using is a series of commensurately universal statements (counter-predications) which either relate a series of features to the same kind as *idia*, establishing that it really is a kind, or to each other (thus, in a sense, *making* a kind). Any one of these co-extensive differentiae may be considered as good an 'explanation' of any other as 'the moon's failing to cast shadows' is of the moon's being in eclipse. That is, without more by way of causal investigation than *Historia Animalium* provides, you will have nothing more than the materials for what the *Posterior Analytics* terms *holi*-demonstrations. But that should be enough to make you confident that these predicative relationships have a causal explanation, even if you don't yet know what the explanation is.

This constitutes a claim about what the *Historia Animalium* should be doing, if it is doing something which corresponds to a pre-causal inquiry as envisaged in the *Posterior Analytics*. It successfully integrates my earlier ideas on the role of the search for the commensurate universal in the *holi* inquiry, and on *HA* as such an inquiry, with Charles' notion that a *holi* inquiry (Stage II) ought also to be concerned with establishing the existence of natural kinds.

Yet there remains a major disagreement between Charles and Lennox regarding the extent to which establishing that a kind exists *should* involve, and in fact in *HA* *does* involve, preestablished views regarding which sorts of differentiae should be considered at the outset as relevant to a Stage II inquiry. In arguing that Aristotle is consistently focused on a 'shortlist' of *de Anima*-like soul-functions, he is bucking a trend initiated by David Balme's research, which indicates a significant lack of concern in *HA* for the 'essence/accident' distinction in Aristotle's biology [cf. Balme 1987a 11, 19; Balme 1987c 291-312].

Now there is a way of stating Charles' thesis which makes it thoroughly uncontroversial. For it is possible to say that virtually every feature of an animal is related to one or the other of the *de Anima* soul-functions. But judging by the way in which his position is defended, this is not the form of the thesis he wishes to defend. Rather it is that the central focus of *HA* is on the parts *directly* involved with carrying out the primary soul functions.

Stated in this robust way, there certainly are *prima facie* anomalies for the view. First, why do differences in the features which Aristotle identifies as the most common and most necessary feature of animals — perceptual organs — play virtually no role in locating Aristotle's list of large kinds? And second, why is there so much discussion of things like one kind being a different color or size from another, or bathing differently than another, or being a friend or an enemy of another, or being gregarious or a loner. The *HA* would be a much shorter work

were it restricted by Charles' robust theory of natural kinds. And finally, when we are told so much about the organizing principles of this work in chapters 1-7, why are we not told about this one?

Further, by insisting that a central focus of *HA* is on fixing natural kinds, and on *taxonomic* considerations generally, he is bucking another trend, also initiated by Balme [1961, 1962, 1972, 1987b] and developed significantly by Pellegrin [1982, 1985, 1986, 1987], Lennox [1987, 1990] and Gotthelf [1988] that sees an activity preliminary to causal explanation as the central concern. On this view, taxonomy, at least as the term has been used since the eighteenth century — to imply classifications which are absolute (rather than context relative), hierarchical and exhaustive — is not an aim of the *HA*. To imagine that it is forces the reader to miss the actual principles by which the work is organized. As Balme repeatedly reminds us, the work is organized first and foremost by differentiae, leading to facts about *gene* being scattered throughout the work (note the extension of, and distances between, Bekker lines on fish in Charles' discussion). This makes the construction of a profile of one of these kinds damnably difficult, and if one imagines this was Aristotle's aim, one concludes as Charles and many before him have — Aristotle's argument is 'concealed' and a mere 'blueprint' of a taxonomy. Balme has been arguing that Aristotle is quite explicit about what he is doing, and there isn't even a blueprint of a taxonomy here, though there are lots of classifications.

For the remainder of the discussion, and in the interests of stimulating further discussion, let me lay out certain of 'the appearances' about *Historia Animalium* which any theory of its character must save. First, some negative appearances. (When I say that *HA* lacks this or that in what follows, the claims are governed by an 'always or for the most part' operator, as an indication of the overall character of the work: there are exceptions.) I believe at this point than many of these appearances favor the 'empiricist' reading — but at this stage of the dialectic, it is keeping these before us that is most important.

Tithenai ta phainomena

1. *HA* lacks modal operators, even though it is full of explicitly universally quantified affirmative and negative statements. The same or similar statements in the rest of the 'biological' corpus are typically modally qualified.

2. *HA* lacks the language of *ousia*, *logos tēs ousias*, *to ti ēn einai*, *to X einai*, while the rest of the biology, uses this language at crucial junctures (see Gotthelf 1985a, 1987 for a list and discussion of such passages).

3. Finally, it lacks, and announces that it *should* lack, the vocabulary of causation and explanation. (The announcement is at *HA* I. 6 491a7-14 — it tells us the search for causes must come after the inquiry to follow).

Now for some affirmations

4. Its first and foremost principle of organization is by the four main types of differentiae named in its introduction: parts, activities, sorts of lives, character traits [*HA* I. 1 487a11-14]. Thus for any given animal, there may be four distinct kinds of claims about it, and within each of those kinds of differences a number of distinct claims. These will be scattered throughout the nine books.

5. Within this framework, it uses the notions of analogy, sameness in kind, the more and the less, variation in degree, sameness in form, in the way his introductory discussion of these concepts would lead one to expect, even explicitly extending it from its primary application to parts' activities and characters in *Historia Animalium* VIII. 1.

6. As the work of Balme [1961, rev. 1975; 1987b] and Pellegrin [1982, 1985, 1986, 1987] have established, the use of the term *genos* holds no specific taxonomic reference; local varieties of sheep as well as the entire realm of animals can be called a *genos*. I suspect this means that, if we are to suppose any concern with the identification of natural kinds in the *HA*, we must imagine Aristotle to be aiming at identifying *scientifically significant* kinds. Notice how, in discussing divisions of groups like insects into winged and non-winged (below, 8.) various popularly named groups such as bees and flies, are, to use Balme's phrase, called in only as witnesses of the difference, not as the object of investigation *per se*. Many of the references to specific kinds of fish discussed in Charles' paper function in the same way.

6. Many of the terms which refer to groups of animals all of which have the differentia under consideration are what *Posterior Analytics* terms 'name-like phrases'. The *Analytics* explicitly seeks to extend the domain of science by allowing for definitions of groups designated by such phrases (see 12. below, and the account of definition in *APo.* II.10 93b29-32).

7. These phrases usually serve to 'unite' animals together for which the common user of Greek had no single name: the sheath-winged ones, the four-legged and egg-laying ones, the blooded ones, the ones with the crooked talons. The list includes all but three of his *megista genē*.

8. There are a number of patterns of presentation of information that recur very often, thus suggesting that they reflect some underlying method. The first is exemplified by the following, which happens to be the last paragraph of *HA* IX. We might call this the 'division and correlation' pattern.

Of the birds, there are the dustbathers, the waterbathers and those which are neither. As many as are not able to fly but are ground-dwellers dustbathe, e.g. the hen, partridge, francolin, lark and pheasant; and some among those with straight talons, and as many as pass their days in the rivers, swamps or seas, waterbathe; while yet others do both, that is both dustbathe and waterbathe, e.g. the pigeon and sparrow. The majority of the crooked taloned ones do neither. [*HA* IX 633a29-b5.]

Imbedded in this passage is the following information.

- a. *Kind* Birds
- b. *Forms of Bird* Crook-taloned, Straight-taloned, Water-dweller, Ground-dweller.
- c. *Character Trait* Manner of bathing
- d. *Forms of Trait* Dustbathing, Waterbathing, Combined.
- e. *Correlations*:

- 1. Birds either dustbathe, waterbathe, do both or do neither.
- 2. As many as can't fly and are ground dwellers are dustbathers.
- 3. Some straight-taloned birds waterbathe.
- 4. As many of the [*birds, straight-taloned birds*] as pass time around water waterbathe.
- 5. Some birds do both.
- 6. The majority of the crooked-taloned birds do neither.

Another example of this pattern occurs in the discussion of the parts of bloodless kinds in Book IV:

In addition to their other parts, the flyers among the insects have wings. But some of these are dual-winged, as the flies are, while others are four-winged, as are the bees. None with only two wings has a rear stinger. Again, some of the winged ones have a sheath for the wings, as does the cockchafer, while some lack a sheath, as does the bee; but the flight of none of these involves the rump, and the wing has no quill, nor is it split. [532a19-26]

Such passages as these, and there are many, seem to me both to lay out divisions, and to establish correlations between the differentiae of the divisions and between these and the animals which are themselves grouped on the basis of various different features, perhaps based on other divisions.

9. Another common pattern, at least in parts of the *HA* (and especially the parts on parts of blooded animals), first noted by Allan Gotthelf [cf. Gotthelf 1988], is the use of relative clauses with *hoson*, as

the subjects of already quantified, sometimes universally quantified, main clauses, the forms being:

As many as are [have] X, all/many/some/none are [have] Y.

This pattern usually occurs within that described under 8., above, and thus, if one is careful, one can usually identify an implied substantive for the indefinite relative — 'As many [of the Quadrupeds] as are viviparous, all have an esophagus and a windpipe'. Through the first four books I noted 31 expressions of the form 'As many as are X are also Y'; 22 of the form 'As many as are X, all are Y'; 15 of the form 'All which (*panta hosa*) are X are Y'; and 16 which are of various forms which don't involve universal affirmatives, i.e. 'As many as are X, few are Y/many are Y/most are Y/none are Y/some are Y, some are Z'. Interestingly, the frequency of these expressions is very high in some stretches of text and very low in others, for reasons which are not yet obvious to me. These expressions serve to express the extent of one feature *relative to* animals picked out solely in terms of another feature, while leaving open the *absolute* extension of the correlation.

10. The next pattern that occurs over and over is the distinguishing of features as *idia* of a kind or as common both to the kind being discussed and to others. In the discussion of the external non-uniform parts of birds [503b29-504b12] we are first told what they have in common with the groups already discussed [b29-34], and then many other things peculiar to birds and sub-groups of birds are noted. Explicitly called *idia* of birds are feathered wings [503b35], the beak [504a20], the toe arrangement and tongue of the wryneck and its ilk [504a13], and the fleshy crest of the cock [504b11]. The chapter dealing with the external parts of fish begins, as *PA* I. 2-4 would lead us to expect, by saying that 'among the water-dwelling animals, the *genos* of the fishes is one marked off from the others, and embracing many forms (*ideas*)' — the fish have one nature, and many forms not very different. Fish share relatively little with the other, land-dwelling blooded animals just discussed: head, back and belly are mentioned [504b14-15]. By comparison with these others, it is more interesting that they have *no* neck, limbs, testicles, or breasts; the mention of this latter privation triggers a discussion of how widely this lack of breasts extends — is it simply the ovipara? No, even the ovo-vivipara lack them, though the dolphin, superficially like some of the selachians, is pointedly noted to have them. All this goes on in a dense stretch of text from 504b18-23. The crucial restriction of breasts is stated this way: 'Now it is not just that none of those which don't bear live generally are without breasts, nor that all those which bear live have them, but as many [of these] as bear live within themselves and do not first produce an egg.' Here Aristotle is meticulously pointing out the

co-extensiveness of mammae with the *true* vivipara. We must, I think, avoid the habit of thinking that Aristotle entered the study of animals with a classification of the animals into the true vivipara and the ovo-vivipara. It is, I suggest, by noting correlations like this one that groups with many differentiae in common varying by the more and the less are identified.

Mentioned as an *idion* of fish are 'gills' [504b28], differentiated among the fish by how many there are on each side, and whether they are covered or not, explicitly included as variation in degree by *HA* I's discussion of the concept. What, nothing else? Actually, there is surprisingly little by way of external parts that holds true for the whole group of fish. They don't all have fins [504b33-5], they don't all lay eggs externally [505b3-4], they don't all have scales [505a22-28]. So Aristotle discusses the differences in these features within the more restricted kinds which have them.

11. A variation on this 'common/peculiar' pattern (which as I noted often has embedded within it the 'division/correlation' pattern) is one where Aristotle begins with a long list of what belongs to all of the most general kind under discussion, distinguishes sub-kinds of this, and notes what is peculiar to the sub-kinds. This pattern is particularly obvious in the discussion of the bloodless kinds [*HA* IV.1-7]. Here, I suggest, there are many features which belong to all and only a popularly recognized kind, so that, rather than building up a profile of a kind via counter-predication, one simply *establishes* this group as a real kind. Interestingly, the *hosa* propositions are virtually non-existent in these chapters.

12. Moving now beyond 'common patterns' found in the *Historia Animalium* (without implying that even the surface has been scratched), I want to discuss a couple of passages where Aristotle notes a grouping of animals that have not been named by one name. For it is in these passages that I think Charles' idea of the *Historia Animalium* as establishing kinds, as opposed to mine of it as establishing 'thats' to be explained, can be seen. His idea is that Aristotle has a sophisticated notion of a common nature which he takes to the enterprise. I have suggested a weaker notion than Charles', which he calls the 'empiricist' concept. Evidence of a *common nature* is a group possessed of *many correlated differences, differentiated by no more than the more and less*. He suggests, in addition, that it will be differences related to *de An.* potentials that will be especially a matter of focus. Now actually, this sounds as if the discovery of coextensive differentiae is at least an important necessary condition for establishing the existence of a kind, which is a much stronger role than Charles wants to give it. But let us see, at any rate, what is explicitly said in these passages. Take the opening lines on the parts of insects.

Let us speak in the same way about the insects. This kind exists having many forms in itself, and some which are kindred to one another have not been linked together by a common name, for example in the case of bee, hornet, wasp and all such ones, and again as many as have the wing in a sheath, for example the cockchafer, stag-beetle, blister-beetle and as many others as are such. [HA IV.7 531b21-5]

Aristotle makes no recommendation in this passage. However, along the lines of the recommendations of PA I.3-4 for establishing a kind, it sounds as if Aristotle has his eye on two candidates for 'intermediate' groups here. The basis for constructing such groups would be a number of forms sharing certain features not belonging to others, and variations in degree of those features. In the remainder of the discussion of the external and internal parts of insects no other features co-extensive with wing-sheaths are noted, while many features common to all insects are.

In *Posterior Analytics* II.14 focused on the method to be used in 'grasping problems', which I take to be the process of finding the predications within a kind appropriate to explanation, Aristotle first uses an example with one of PA I's commonly (and correctly) recognized kinds, Bird. He then goes on:

Now at present we are speaking in terms of the traditional common names; yet it is necessary to investigate not only in these cases, but if anything else is seen to belong in common as well, selecting it we must then investigate what it follows and what follows it — e.g. having a fourth stomach and being without both rows of teeth follow having horns. Again, possessing horns follows something; for it is clear why what we mentioned will belong to them, for it will belong because they have horns.[98a13-19]

Here, by way of an example well-known to readers of the biology, Aristotle recommends extending the method of 'counter-predication' to groups of animals that have not been named by the *hoi polloi*. The previous paragraph lays out the method of counter-predication by recommending positing the kind common to all (e.g. Animal), selecting what belongs to every member of the kind, and then moving to the first remaining kind (e.g. Bird) and repeating the procedure.² Yet even where no common kind has been named, there may be recognizable correlations among differentiae at a general level that this method of selecting from divisions and dissections may help us to identify. In so doing, we will see (perhaps) a group of animals, not commonly named, that have a number of differences in common, and forms not very different. That is, in so doing we may see groups that in all likelihood have a common nature. Perhaps this is one thing that is going on in the

(2) For a more detailed discussion of this passage and the *Prior Analytics* I.27-30 background, see Lennox 1987 and 1990.

passage which discusses the two groups of unnamed insects. (Cf. the similar passage in HA IX.40 623b5-8).

Caution is called for, however: the HA never discusses the notion of a common nature in making these points. A passage in PA III.6, which I have discussed elsewhere and which Charles discusses above in note 27, certainly does, however. There he suggests that just as the name Bird applies to a certain kind on the basis of the being of a bird being 'from something', so having a lung belongs in the *ousia* of the animals that have lungs. [669b8-12] One has to be careful not to over-read this passage: it doesn't say, as Peck's translation does, "There is no common name which applied to all animals that have lungs. But there ought to be, because..." All it says is that what is common to these animals is unnamed — Period. Still, read against the background of the *Historia Animalium*, *de Juventute* and the rest of the PA on the interconnected set of organs, activities and forms of life centered around manner of cooling, it is hard not to think that Aristotle is suggesting that here is a common nature, with variations of more and less across many correlated differentiae — i.e. here is a true *genos*, as deserving of a name as Bird is.³

There are two deeper problems raised by Charles' paper which I wish to finish by mentioning. I have proceeded on Charles' assumption that a significant part of Aristotle's energy in the earlier part of a

(3) Charles discusses this passage in his note 27. On his reading, the passage makes three essential points which he thinks severely limit the role of counter-predication in establishing the existence of a genus. These are [i] that because there is no common name which applies to the kinds with bloodless lungs this fact (presumably that they have bloodless lungs) appears in the specification of their essence; [ii] that there is no one genus of bloodless lung possessors in contrast to the birds; and [iii] that having lungs appears in the specification of the essence of groups marked out on other grounds.

I don't think this reading can be correct. First, Aristotle is explicit that there is a single *genos* [*genous tinos*] for which bloodless lungs exist. The problem is not that these don't constitute a *genos*, but that what is common to these (presumably these *animals*, not kinds) is without a name. Now the reference to 'the common thing' which lacks a name can be read in a number of ways — the reference might go back to the lung in 669b8, and imply all the animals with lungs generally; it might mean something common to animals with bloodless and blooded lungs, in which case what is common would still be possession of lungs, or it might refer to bloodless lungs being common to all the animals with bloodless lungs, the group which is unnamed. The last sentence favors one of the first two options. But at any rate the contrast of these animals with the birds is that birds have a name which applies to the *genos*, while what is common to this group is unnamed. And finally, the passage says nothing about lungs being in the essence of "different genera marked out on other grounds", only that 'possession of a lung is in the being of these animals' which is somehow analogous to the way the being for Bird comes from something. On the usual reading of this passage [cf. Lennox 1987 117, Gotthelf 1985 31-33, Balme 1972 120, 1987b84-85], Aristotle is seriously contemplating a group wider than Bird. Notice that the members of such a group would not merely share a lung, but also many features coextensive with a lung: a neck, an esophagus, a windpipe, an epiglottis or analogue, life dependent on air, and cooling by taking in and expelling air.

natural inquiry will be devoted to establishing the existence of kinds with common natures. My goal has been to suggest a way in which this enterprise can be seen as complementary to what Balme, Gotthelf and I have been saying is going on in the *Historia Animalium*. But given the use of *genos* in the *HA*, and given Aristotle's predilection for adopting 'single character' groupings of animals (e.g. those that dustbathe), there is a serious question to be raised about whether the *Historia Animalium* is interested in 'robust natural kinds' of the sort Charles is interested in. An interest in causal explanation of differentiae is quite explicitly acknowledged; an interest in definition is not.

Supposing such an interest can be shown, what are the kinds that Aristotle is after? In *Posterior Analytics* II every explicit example connects definitions with demonstrations through the middle term referring to the essence of the *major* term in the demonstration: if the *explanandum* is thunder (a certain noise) in the clouds, the middle term (extinction of fire) defines *thunder*. How does this work with natural substances? He suggests it does in *Posterior Analytics* [90a9-12, 90a32-4, 93a23-4], and *Metaph.* Z.17 1041b4 ff. wheels in the matter/form/composite distinction to make it work. In thinking about animals, is Aristotle focused on grasping and defining kinds of animals, or do these gradually emerge from a primary activity focused on finding co-extensive differentiae?

Finally, there is an even more troublesome nest of problems all related to questions about what the written *Historia Animalium* represents. There are at least three very different possibilities, and the role of guiding assumptions about animal natures might well differ depending on which is nearest the truth.

1. The *HA* is a finished and organized report of an inquiry, but not explicitly pedagogical in aim.
2. The *HA* is primarily a teaching tool, organized in a certain way because of its place in a course of instruction for natural philosophers.
3. The *HA* is like a file folder, a way of storing the information from an ongoing inquiry into animals.

Though it is obvious, it is easily forgotten that none of these is identical with the actual gathering of information that the *HA* reflects — an activity which included interviewing, observing, dissecting, reading travelogues, works 'On Nature', other 'histories', medical texts, and so on. And perhaps between the two, there was apparently a semi-technical enterprise of constructing divisions.

When Charles discusses *HA* as representative of a 'Stage II' inquiry (or enquiry, as he prefers), it will be worthwhile to know [a] how he conceives of the written *HA* and [b] whether what is true of it is true of the inquiry itself.

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THE EPISTEMOLOGICAL BASIS OF ARISTOTELIAN DIALECTIC

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Just as people judge the value of currencies
by reference to the currency most intelligible to
themselves, so is it in other areas as well.

History of Animals I.6 491a20-22

Dialectic is peirastic when it concerns matters
which philosophy treats with knowledge.

Metaphysics IV.2 1004b25-26

1. CONFLICTING VIEWS OF DIALECTIC

In recent accounts of the procedures which Aristotle recommends and uses in order to reach and to justify the results presented in his works reference to his method of dialectic looms large. This is in marked contrast to the approach to Aristotle's methodology offered by leading scholars only a short time ago. Ross, for example, summed up his own account of Aristotle's view of the merits of dialectic in the following way:

The discussion [of dialectic in the *Topics*] belongs to a bygone mode of thought; it is one of the last efforts of that movement of the Greek spirit towards a general culture, that attempt to discuss all manner of subjects without studying their appropriate first principles, which we know as the sophistic movement. What distinguishes Aristotle from the sophists, at any rate as they are depicted both by him and by Plato, is that his motive is to aid his hearers and readers not to win either gain or glory by a false appearance of wisdom, but to discuss questions as sensibly as they can be discussed without special knowledge. But he has himself shown a better way, the way of science; it is his own *Analytics* that have made his *Topics* out of date.¹

(1) W. D. Ross, *Aristotle*, 5th ed., 1949, p. 59. Cf. F. Solmsen, *Die Entwicklung der arist. Logik und Rhetorik*, Berlin 1929, p. 26: "analytics supercedes dialectic."

Recent writers have taken a view of dialectic quite opposed to the one summarized by Ross. Finding little or no indication that the method for finding and laying out demonstrations described in the *Analytics* is actually guiding Aristotle's thought in his philosophical and scientific works, scholars have turned to his descriptions of the method of dialectic, in the *Topics* and elsewhere, to find the key to understanding his procedures. The following summary assessments express a widely influential current estimate of Aristotle's attitude toward dialectic as a tool for not only philosophical but also scientific inquiry:

[Aristotle] nowhere suggests that any other method will lead to results which conflict with or go beyond the results achieved by the method of *endoxa* [i.e. by dialectic].

[Aristotle] establishes *science* on the basis of the opinions of 'the majority' and 'the wise'... He announces time and again that the way to the truth is through the study of 'reputable' opinions [i.e. through dialectic].²

In place of the earlier view that the method of the *Analytics* supercedes and replaces the method of dialectic, the view now more dominant is that whatever other methodological procedures Aristotle may introduce none is intended in any way to supercede dialectic as the proper method of scientific or other inquiry and, in particular, as the proper method to use to discover the first principles of the sciences. By contrast, the method of searching for and setting out demonstrations which is discussed in the *Analytics* is commonly taken nowadays to have to do not with genuine discovery or the epistemic justification which that may involve, but only with what is required, after dialectical inquiry is completed, either to systematically *display* the results of inquiry, or to *impart* these results to learners or to deeply *understand* these results.³ Other views of dialectic and its relation to demonstration than these two sharply opposed views have been taken. Some have wanted to distinguish those scientific works in which Aristotle's method *is* dialectical (including, typically, the scientific works we regard

(2) J. Barnes, "Aristotle and the Methods of Ethics," *Rev. Int. Phil.*, 1980, p. 495; M. F. Burnyeat, "Good Repute," *London Review of Books*, Nov. 6, 1986. Barnes prefers to refer to Aristotle's supreme method as "the method of *endoxa*," a description not used by Aristotle. But Barnes is, of course, clear that "*endoxa* form the subject matter of dialectic." See also M. Frede, *Essays in Ancient Philosophy*, 1987, p. 95 ("As with all other sciences, one arrives at [the] starting points [of metaphysics] dialectically.") For further references see R. Bolton, "Definition and Scientific Method in Aristotle's *Posterior Analytics* and *Generation of Animals*," in A. Gotthelf and J. Lennox (eds.), *Philosophical Issues in Aristotle's Biology*, 1987, n. 4.

(3) The three views mentioned are defended, respectively, in G. E. L. Owen "Tilthenai ta phainomena," 1961 (in J. Barnes *et al.*, *Articles on Aristotle I*, 1975), J. Barnes "Aristotle's Theory of Demonstration" (in *Articles on Aristotle I*) and M. Burnyeat "Aristotle on Understanding Knowledge" (in E. Berti ed., *Aristotle on Science*, 1981).

as most philosophical such as the *Physics*, *De Anima* and *Metaphysics*) from others in which he uses, or also uses, non-dialectical empirical methods. But even the defenders of this approach have commonly also claimed that for the discovery of first principles in science dialectic is the method which Aristotle recommends and regards as sufficient.⁴ Generally speaking, then, the two sharply opposed views represent the dominant tendencies in recent scholarship and it will be helpful to concentrate on them for the exploration of the epistemological issues to be discussed here.

2. WHAT IS DIALECTIC? A FIRST APPROACH

Before considering these two views of dialectic further, it will be useful to remind ourselves in a general way of what the method of dialectic is, which has been viewed so differently by two different generations of scholars. A convenient place to begin is with the opening sentence of the *Rhetoric*.

Rhetoric is a partner of dialectic. For both of them are concerned with the sorts of things which it is in a certain way common to everyone to know and which require no specialized knowledge. Thus everyone in a certain way takes part in both dialectic and rhetoric. For everyone on a limited basis engages in examination and in submitting to argument; and also in defending himself and accusing others. (1354a1-6).

Here Aristotle points out that dialectic, like rhetoric, is a procedure for argument or reasoning on the basis *not* of expert knowledge of a given science or other discipline but rather on the basis of what it is "in a certain way common to everyone to know." (1354a2-3) The remark quoted at the head of this discussion, as well as the present passage, makes it clear that, in Aristotle's view, reasoning on such a basis is a fundamental part of the rational life of people in general. In the *Rhetoric* he explains how this is so. "Everyone on a limited basis engages in examination [of claims] and in submitting to argument [when under examination]." (1354a4-5) We all regularly test the claims of others in deciding whether to accept them, and submit in turn to the testing of our own claims by others, in the ordinary course of life. But this mode of reasoning which everyone engages in, and not just the learned, requires a basis for argument and a method of procedure which is suitable for use by and with everyone. This is dialectic. So just as Aristotle's interest in how the rational life of people in general is best led motivates him to describe and codify the proper technique of rhetoric,

(4) See Owen 1961, p. 118; G. E. R. Lloyd, *Magic Reason and Experience*, 1979, p. 118 and T. Irwin, *Aristotle's First Principles*, 1988, Ch. 2 *et passim*.

which everyone engages in (1354a5-6), it equally motivates him to do the same for dialectic, which everyone also engages in.

It is important to keep in mind what this main social setting is in which dialectic is conceived by Aristotle to have its original home. Sometimes accounts of dialectic concentrate on the undeniable fact that dialectic came to be practiced in the Academy, and elsewhere, as a quasi-sport for the purpose of mental gymnastics or training.⁵ With this in view the dialectical method of the *Topics* has been described as, quite generally, involving no serious concern for truth. But in *Topics* I.2 Aristotle distinguishes the gymnastic use of dialectic from two other distinct uses: the universal use, described at the beginning of the *Rhetoric*, in ordinary discussion or conversation in order to correct the mistakes of others and submit to the same process ourselves (101a27, 30-34; cf. *Rhet* I.1 1355a24-29); and a pair of uses in science — an aporetic use in raising genuine problems for both sides of an issue so that “we may more easily discern what is true and what is false” (101a34-36), and an essential use in reaching the first principles of the sciences (101a36 ff). If dialectic involves “no serious concern for truth”⁶ or,

(5) See G. Grote, *Aristotle*, 2nd ed. 1880, p. 271; H. Cherniss, *Aristotle's Criticism of Plato and the Academy* I, 1944, p. 18; J. Brunschwig, “Aristotle on Arguments Without Winners or Losers,” in *Wissenschaftskolleg Jahrbuch* 1984/5, Berlin 1986, p. 40. The views of Grote and Cherniss are criticized by Owen in *Aristotle on Dialectic* (1986), pp. 103 ff. Brunschwig resuscitates a version of their view.

(6) Brunschwig, *ibid.*, p. 40. Brunschwig argues that there are “discrepancies” and “inconsistencies” in what Aristotle says about the use of dialectic with ordinary people which “seem to show that he is uneasy” about the use of dialectic except for school gymnastics. (p. 34) He argues that Aristotle claims at 105a16-19 and 157a18-21 that “dialectical deduction (*sullogismos*) should be employed only with trained dialecticians,” while induction is to be used with ordinary people. Since “the official subject of the *Topics* is dialectical *sullogismos*” the *Topics* teaches us how to proceed “with well-trained dialecticians not with ordinary people.” Of course, Aristotle flatly contradicts this conclusion at the beginning of *Topics* I.2. (The *pragmata* of 101a26 is the one described at 100a23.) Is this inconsistent with what he says later? At I.12 105a16-19 he says at most that induction is *more* effective with people in general, *sullogismos* is *more* effective with trained arguers, not that one type of argument is exclusively to be used with either group. At VIII.2 157a18-21 he repeats the same point. (The reference here back to the earlier passage shows that *mallon* means *more* not *rather*.) More importantly, he repeats the point in a context which clarifies its import. The contrast between the two types of argument, inductive and syllogistic, is introduced in this context to describe two possible ways of obtaining the necessary premises for a *sullogismos*. (VIII.1 155b20-22, b35-156a11) That is the topic under discussion. Later in VIII.8 Aristotle even describes a premise of an inductive argument which yields a premise for the main syllogism as itself a “syllogistic premise,” i.e. a premise concerned with the (main) syllogism. (160a35 ff) Thus, at VIII.2 157a18 ff when Aristotle is recommending *induction* for use with ordinary people it is for the purpose of obtaining the *necessary premises* for a *sullogismos*. (One reason for this recommendation is given at 156a3-7, cf. 105a16-19). He recommends *sullogismos* for the same purpose in dealing with dialecticians. (One reason is given at 156a7-11, with 156b27-30). So Aristotle does not later contradict his claim in *Topics* I.2 that one use of

more precisely, if it does not in any of its forms reliably provide us with better grounds for believing what is true than for believing what is false, then it is hard to see how it could be rational to use dialectic to perform the non-gymnastic functions, whether everyday or scientific, which Aristotle assigns to it. Of course, Aristotle needs to show us that the procedures of dialectic are ones which it is rational for us to employ for purposes other than mental gymnastics. It will be useful, in our attempt to see how he does this, to begin with a rough description of dialectical procedure.

At the beginning of his official treatise on dialectic, the *Topics*, Aristotle makes it clear that a leading feature of the method is a special procedure for arguing for claims and for defending claims against objection. Roughly speaking, on this procedure a claim may be said to be “dialectically justified” just in case either it follows in an appropriate way from items which belong to the existing set of noted or accredited beliefs or it is consistent with (i.e., its contradictory does not follow in an appropriate way from) items in this set of beliefs. (*Topics* I.1 100a18-30)⁷ The noted or accredited beliefs, or *endoxa*, which make up this set Aristotle limits to “the things which are accepted by everyone, or by most people; or by the wise — either by all of them, or by most, or by the most famous and distinguished.” (*Topics* I.1. 100b21-3) The noted or accredited beliefs which belong in this collection include not only those which concern some particular subject matter such as physics or ethics but also those which have to do with what Aristotle calls logic (*logikē*), that is with the canons or techniques for arguing *about* questions of physics or ethics or anything whatever. (I.14 105b19 ff).

the mastery of the dialectical *sullogismos* (100a22-4) is for discussions with people in general (101a25-27). His later remarks only concern how best to obtain the necessary premises for such a *sullogismos* in discussion with different groups. (See also the references to the securing of premises at VIII.2 157b28 ff, 158a14 ff.)

At VIII.14 164b8 ff, as Brunschwig notes, Aristotle says that dialectic should not be used with “everyone,” and gymnastic dialectic should not be used with “just anyone.” Some people are too competitive in argument for this, he says. But there is no suggestion that these hyper-competitive people are the ordinary people rather than, say, mainly trained dialecticians, or some of each.

(7) The successful syllogistic reasoning, from (appropriate) *endoxa*, for a certain conclusion, which Aristotle mentions in this passage, he typically takes to be, in a dialectical discussion, the work of the *questioner*. (*Top.* VIII.6 160a12-13) In this case the proposition which is “dialectically justified” is opposed to a claim which the *answerer* is set to defend. The successful *submission* to argument, from *endoxa*, without having to say anything inconsistent, is, in a dialectical discussion, the work of the answerer. (*Top.* VIII.5 159a38 ff) In this case the proposition which is consistent with the (appropriate) *endoxa* and thereby “dialectically justified” is a claim which the answerer is set to defend. Just what the relation between and what the value of these two modes of justification is will be explored further below. The term ‘dialectical justification’ is used here in a technical sense to refer to whatever kind or kinds of justification it may be that the questioner or the answerer, or both, have in either of the two cases.

The *Topics* itself is, in fact, mainly concerned with setting out an accredited list of these canons and techniques of argument.

This initial description of the method of dialectic is, intentionally, rough and in various ways imprecise and incomplete; and much will need to be done to improve it. But the description will do well enough as a starter for us to begin to see how one might categorize the method of dialectic from the epistemological point of view so as to raise some questions about its potential philosophical interest. As described so far, dialectic might well seem to embody a version of a *coherence* theory of justification for claims and beliefs since it takes a claim to be justified just in case it is, in an appropriate way, consistent with or implied by certain standing noted or accredited beliefs. If so, then if it is the case, as is now widely held, that the method of dialectic is on its own totally adequate and sufficient for Aristotle for the justification of results in science, in philosophy and elsewhere, then he favors some form of coherence theory of justification in epistemology generally, a line which some people have in fact recently taken.⁸ Or, more cautiously, to the *extent* that Aristotle regards this method as sufficient to that extent it might appear that he favors a coherence theory of justification. If he does, or to the extent that he does, then it would be of interest to know what form of coherence theory he holds and why he does so; and also to know how his reasons for adopting a coherence theory may be related to those which lie behind the recent resurgence of theories of this type in contemporary epistemology. Is Aristotle's theory, like some current theories, developed in response to the conviction that there are no incorrigible or self-certifying beliefs, due perhaps to the theory-laden character of all beliefs? Or is it developed, like other current theories, out of the conviction that appeal to what lies outside what is most fundamental in our customary *scheme* of accredited beliefs is somehow incoherent? Or does it have some other basis, different from any contemporary one?

3. OBJECTIONS TO THE SUFFICIENCY OF DIALECTIC

There is a well-recognized difficulty which needs to be mentioned at the outset which stands in the way of attributing to Aristotle a commitment to the total sufficiency of the method of dialectic in science, or in some sciences, and to the sort of coherence theory of justification that might be involved in it. Aristotle distinguishes in the very passage

(8) See, particularly, T. Irwin, "Aristotle's Methods of Ethics," in *Studies in Aristotle*, ed. D. O'Meara, 1981, pp. 207-8.

in the *Topics* where he gives his clearest general description of dialectic a class of propositions — the first principles of the sciences — for which "it is not necessary to inquire why they are so; each of the first principles is worthy of belief on its own." (*Topics* I.1 100b19 f) Justified belief in these propositions, it would seem, does not ultimately depend on an apprehension of their coherence with any other beliefs or propositions at all.⁹ However, some recent writers have argued that there is a way of understanding this doctrine so that it is compatible with a commitment on Aristotle's part to the sufficiency of dialectic for justification. Others have argued that Aristotle came to abandon this doctrine when he saw properly the value of a special kind of dialectic.¹⁰ In the latter case, it could be argued that Aristotle at least *came* to favor a coherence approach in epistemology¹¹ and the question as to what motivated his *change* of mind would be of special interest.

This is a matter which deserves further discussion. But we do not need to settle it here. Even if it is the case that this traditional problem does not in the end stand in the way of supposing that Aristotle regarded, or came to regard, the method of dialectic as sufficient for discovery and for the justification of belief, in all or in certain sciences, there are at least two other considerations which make it clear that, for him, the proper practice of scientific method clearly can and does lead to results which both *conflict with* and *go beyond* results reached by dialectic. First, Aristotle's method of discovery and of justification in natural science generally is *empirical* in important respects in which dialectic cannot be. Aristotle requires that scientific theories are reached and confirmed ultimately by reference to the data of perceptual observation *by contrast with* accredited beliefs or *endoxa*. (*De Caelo* III.4 303a20-23 with III.7 306a3-17: both quoted shortly below.) In his actual practice in his scientific works he often appeals to new perceptual data which, as he sometimes explicitly claims, contradict all standing opinion; and he uses reports of observations which come from sources (such as "some experienced fishermen") which fall outside all of the sanctioned sources of *endoxa*.¹² Put simply, the data base

(9) The difficulty was discussed by J. Burnet, *The Ethics of Aristotle* (1900), *intr.* xli. Burnet solved it by treating dialectic as a method of discovery only, not of justification. Justification was based, he thought, on intuitive awareness of the self-evidence of the propositions in question. Most writers have solved the problem differently.

(10) See M. Burnyeat "Aristotle on Understanding Knowledge" pp. 130-132; T. Irwin, "Aristotle's Discovery of Metaphysics," *Rev. Meta.* 1977, and *Aristotle's First Principles*, 1988.

(11) Cf. Irwin, "Methods of Ethics," p. 208.

(12) See, for instance, *HA* 513a8-15, *GA* 742a16-8; *HA* 532b18-26. Aristotle also often relies on his own new observations which clearly do not (yet) count as noted or accredited beliefs (*endoxa*). See, e.g. *Meta.* I.6 343b8-14. For fuller discussion of these points see Bolton 1987, Sec. 2.

which science works and reasons from includes items which do not count as *endoxa*. So since dialectic is restricted in its data base to *endoxa*¹³ the method of science cannot simply be dialectic. This is brought out quite explicitly in a famous passage from *Generation of Animals* III.10 (760b27-33) which concludes Aristotle's discussion of how bees reproduce.

This is the way things appear to stand concerning the genesis of bees on the basis of reasoned argument and the things which are accepted (*ta sumbainein dokounta*) about bees. But the facts have not been adequately ascertained and if they ever are to be, credence must be given more to perception than to reasoned arguments, and to reasoned arguments only if what they show is in agreement with the *phainomena*.

Here Aristotle explicitly cites a case where the agreement of some theory with what is "accepted," which would at least include agreement with the *endoxa*, is not enough. Further data he says, are required. And the primary test for the credibility of further data, and of any theorizing based on them, is not whether they become *endoxa* or how they fit with the *endoxa* but whether those data are perceptual *phainomena*. It cannot be claimed that this requirement is one which Aristotle invokes only for certain (empirical) sciences and not for others. In the *Analytics* Aristotle explicitly invokes this requirement for "any art or science whatever." (*APr.* I.30 46a17 ff, quoted immediately below.)

Secondly, Aristotle makes it clear that proper scientific method must aim to secure *explanations* in a way that goes beyond what dialectic can achieve. This comes out most clearly if we consider the requirements for adequate *definition* prescribed by dialectic. Dialectic requires, and provides a method for reaching, definitions which are inferable from or at least *consistent* with the *endoxa* or an appropriate subset of the *endoxa*. (*Topics* 100a18-21. The main lines of argument (*lopoi*) for dealing with definitions are given in *Topics* VI-VII.) But adequate scientific definitions must satisfy a different requirement. They must be capable of *explaining* the *phainomena*. (*De Anima* I.1 402b16-403a2, *Prior Analytics* I.30 46a17-22 both quoted below.) Among these data may be items which do not count as *endoxa*, for reasons explained above, and the relation required between the data and the definition is stronger than mere derivability or consistency.¹⁴

(13) This needs certain qualifications which are, however, not important in the present context. See Bolton, 1987, n. 8. Aristotle himself usually states the point without qualification, as at *Metaph.* 995b23-4.

(14) Of course, the *endoxa* with which any dialectically adequate definition must be consistent include *endoxa* about definitions. And it might be an *endoxon* principle about definitions — though it seems it was not in Aristotle's day — that definitions should serve to explain a certain range of empirical data. But even if this principle were *endoxon* that

For both of these reasons the definitions required by science as first principles may conflict with or go beyond those required by or available to dialectic and dialectic is not sufficient to guarantee that a definition appropriate for scientific purposes has been discovered.¹⁵ Again, this is a point which holds quite generally and not for some sciences as opposed to others.

These two crucial features each of which separates scientific method from dialectical method (either as a method of justification or as a method of discovery) are the ones to which Aristotle standardly gives special attention throughout the corpus, in works early and late, in his summary descriptions of proper scientific procedure. The scientist's task, he repeatedly says, is to collect the full range of empirical *phainomena* on some subject and then look for the theoretical principles (preeminently the definitions) which serve to explain these data. Consider the following passages:

Most of the principles in each science are unique to it. Therefore, it is the role of experience (*empeiria*) to yield the principles of each science. I mean, for instance, that experience in astronomy yields the principles of astronomical science, since it was only when the *phainomena* were adequately grasped that the *demonstrations* in astronomy [and thus the *principles* on which genuine demonstrations must be based] were discovered. The same is true of any art or science whatever. (*Prior Analytics* I.30 46a17-22; cf. *APo.* I.13 78b34-79a6, II.19 100a6-b5.)

It does not make good sense for it to turn out [as the Platonists claim] that one element alone [earth] has no part in the transformation [of the elements into each other]. Neither is it apparent on the basis of perception; rather [on this count] all [the elements] change equally into each other. As a result these theorists are offering accounts which concern the *phainomena* while their accounts are not in agreement with the *phainomena*. The reason for this is that they have not proceeded in the

would not permit dialectical argument to secure it that a given definition which does in fact explain such a range of data is the correct definition — even for someone who knew that the definition in question satisfied this principle. It would have to also be *endoxon* that the definition satisfies the requirement before it could be concluded, *by dialectical argument*, that the definition is the correct one. Only *endoxa* can figure as premises in dialectical argument.

That the principle mentioned above was not *endoxon* in Aristotle's day is confirmed by the fact that the *Topics* mentions no such principle in its list of standard procedures (*lopoi*) for the examination of proposed definitions. It does mention the doctrine that a definition should be given by reference to what is prior and more intelligible absolutely. (*Topics* VI.4 141b25 ff) This doctrine is used by Aristotle in his construction of his own view that ultimate definitions should explain the perceptual data on a given subject. (*Physics* I.1 184a18 ff) But no such application of this doctrine appears in the *Topics*. The only use of the doctrine in the *Topics* is to argue that definition must be by genus and differentia since these are prior and more intelligible absolutely than the species. This latter point obviously reflects standing doctrine.

(15) For fuller discussion of this point see Bolton 1987, esp. Sec. 5.

proper manner in the positing of their first principles because they were determined to bring everything into conformity with certain fixed ideas. For surely the first principles which concern sensible things must conform to the sensible, those which concern eternal things to the eternal, those which concern perishable things to the perishable: in general, principles must be conformable to their subjects. But because of their affection for their principles they have behaved like people who are set to defend their theses for the sake of argument. For holding their principles fixed as true they abide any consequence [of them] not seeing that it is necessary to judge some types of principles in the light of their consequences, in particular of what is ultimate. The ultimate thing in the case of practical knowledge is the product, in the case of natural science it is the always authoritative perceptual *phainomenon*. (*De Caelo* III.7 306a3 ff.)

Knowing the accidents of a thing contributes a great deal towards knowing what the thing is. For when we can give an accounting, at the phenomenal level, of the accidents — either all or most of them — we will be able to speak best about the essence. For a statement of what a thing is is the starting point of every demonstration [about that thing], so that insofar as definitions do not lead us to a knowledge of the accidents, nor even lead us easily to likely proposals about them it is clear that they have been offered dialectically and are of no value. (*De Anima* I.1 402b21 ff.)

The reader of such remarks and others like them (e.g., *GC* I.2 316a5-13, *HA* I.6 491a7 ff, *GA* III.10 760b27-33) might naturally be led, as Ross and his contemporaries were, to a view of Aristotle's theory of justification in science quite at odds with the currently standard one. In collecting the appropriate range of *empirical phainomena* and explaining them (in accordance with the canons of the theory of demonstration) why does the scientist need to pay any attention at all to *endoxa as such*? What is important is to collect the proper *empirical* data and explain them. Whether some or all of these data are *endoxa* seems irrelevant; as does the matter of whether the theories one offers to explain the data cohere with the *endoxa*. Looking to the body of noted or accredited belief would seem to have, at most, pragmatic utility, by serving to direct attention to possibly significant data or possibly promising theories; but no capacity to guarantee discovery and no value as such for *justification*. What guarantees discovery and what counts for judging the correctness of theories, it would seem, is the genuine empirical status of the data explained and the genuine explanatory power of the theories. As noted above, Aristotle invokes this requirement not simply for the natural sciences (as in *De Caelo* III.7) but (in *Prior Analytics* I.30) for "any art or science whatever."

This view of dialectic as, in the final analysis, inadequate to guarantee discovery and irrelevant for justification in science is, as we have noted, just the view taken by many scholars in the past before the current trend acquired its prominence. But despite the difficulties for the current view this older view does not at all seem to account for the

role which Aristotle explicitly assigns to the use of *endoxa* in scientific inquiry. He thinks it is necessary to find theories which accommodate the *endoxa* (or at least some appropriate subset of them) *as well as* perceptual phenomena. In the *De Caelo* (III.4 303a20-23) he objects to the physical theory of the Atomists because:

In claiming that there are indivisible bodies they cannot avoid conflict with the mathematical sciences nor the denial both of many *endoxa* and many perceptual *phainomena*.

So he regards it as a legitimate test of the adequacy of theories in physical science that they fit not only with the perceptual *phainomena* but also with the *endoxa*. This is further confirmed by a well-known passage in the *Physics* (IV.4 211a7-11).

It is necessary to try to conduct our investigation so that it is determined what place is in a manner such that the difficulties are resolved, and the things that are held to belong to it (*ta dokounta*) do turn out to belong to it, and, further, it will be clear what the cause is of the trouble and the difficulties about it. For in this way is each thing best established.

Here Aristotle claims it is necessary (though not sufficient) for the best *justification* to find theoretical principles which account for the "things that are held." These, again, must at least include the *endoxa*, or at least some appropriate consistent subset of them. So even though he gives higher authority in justification to perceptual phenomena as such, *endoxa* have value in justification as well. And Aristotle says in *Topics* I.2 that it is *dialectic* which is the proper method to use to determine how theories square with the *endoxa*. (101b1-3) He also claims in this chapter that it is "necessary", and not simply heuristically valuable, to work dialectically through the *endoxa* to reach adequate theoretical first principles. (101a36 ff) He does not restrict this requirement to some sciences as opposed to others but invokes it quite generally for "each science". (101a35) He does speak of the requirement as applying in "the philosophical sciences" (a34); but this does not, as some have suggested, restrict the requirement in a significant way for present purposes. Aristotle counts the scientific study of any real kind as a branch of "philosophy." (*Metaphysics* IV.2 1004a2-9; cf. VI.1 1026a18 ff.) One might perhaps suppose that the task of "dealing with the first principles," for which dialectic is essential, is a very small or special part of the scientific enterprise. Even if this were so it would, of course, be important to understand how dialectic can play a *necessary* role in this process. But various passages make it clear that this task is coextensive with the scientific enterprise as a whole. In the first chapter of the *Physics* for instance, Aristotle *identifies* scientific inquiry (*melhodos*) with the process of the acquisition of principles, and in *Posterior Analytics* II.1-2 he elaborates this point in detail. Aristotle also says that it is "the role of experience to yield the principles... [This]

is true of any art or science whatever." (APr I.30 46a17 ff) That is, Aristotle conceives of the task of collecting and sifting the experiential data as *the* main element in the process of working *toward* the principles, for the obvious reason that the principles are found and validated as the ultimate items that explain this body of data. (De An I.1 402b21 ff, De Caelo III.7 306a3 ff.) Since these two processes, collecting the empirical data and explaining it, are just the ones in which Aristotle claims to be chiefly engaged quite generally in his scientific works, if dialectic is necessary for "dealing with the first principles" in every genuine science then dialectic is a necessary ingredient in the scientific enterprise quite generally. So even though the new view that dialectic is totally adequate has serious deficiencies we cannot simply go back to the old view that dialectic is irrelevant. We need to explain why Aristotle should give special status in scientific method quite generally to *endoxa* and to the method of dialectic which reasons from them, *in view of the limitations of dialectic* as a tool for discovery and justification in science. In particular, we need to understand in this connection why Aristotle should require the scientist to care at all about what people in general credit in physics or biology, or other sciences.

This is a question which has so far received surprisingly little attention, even from those who have regarded Aristotle's method of working through the *endoxa* as, for him, totally adequate for justification in science or elsewhere. There are indications in the recent literature of several different approaches which those who view dialectic as Aristotle's primary method would take in answering the question. But it will be useful, before investigating these approaches, to consider more carefully just what Aristotle himself says about how to do dialectic. If we can see in more detail just what the basic rules of the method are we will in a better position to consider what the value may be of various recent accounts of the ultimate basis of the method.

4. HOW TO DO DIALECTIC: SOME INITIAL QUESTIONS.

In the opening sentence of the *Topics*, to which we have already alluded, Aristotle gives a general characterization of the method of dialectic.

The purpose of this study is to discover a method whereby we shall be able to reason syllogistically from *endoxa* about any problem which may present itself and shall be able to submit to an argument ourselves without saying anything inconsistent. (*Topics* I.1 100a18-21)

In this opening passage Aristotle introduces certain paradigmatic features of dialectical method. He points out at the end of the chapter that his discussion here, and later in the *Topics* as well, is a discussion

"in outline" (*tupōi*), by which he means that it is not "an exact account but only... one which will enable us to understand each subject in some fashion." (101a21-4) This provides for us an important general cautionary note, and in particular it implies that the initial description may in some respects focus only on certain typical or paradigm cases or features of dialectic. It will be necessary to bring certain of these respects to the fore shortly.

In this passage Aristotle mentions two features of dialectic. It provides us with a method for "reasoning syllogistically" (*sullogidzesthai*) and also with a method for "submitting to an argument ourselves" (*auloi logon hupechontes*) without saying anything inconsistent." As his language suggests, Aristotle conceives of the *latter* activity as carried out, in a dialectical question and answer discussion, by the *answerer*, the one who "submits to an argument," from *endoxa*, which is constructed on the basis of premises which are granted by him in response to questions, and attempts to avoid concessions which lead to a conclusion "inconsistent" with what he is set to defend. In harmony with this, Aristotle typically conceives of the former activity, "reasoning syllogistically," as successfully brought off in a dialectical discussion by the questioner.¹⁶ This is because success on the part of the answerer in such a discussion involves, where possible, *avoiding* the concessions which are necessary for *successful* syllogistic reasoning, i.e. reasoning to a conclusion which is inconsistent with what the answerer is set to defend (or what he has granted). So in an important sense such reasoning does not even occur in a dialectical discussion unless the *questioner* is successful. Dialectical reasoning is reasoning "to the contradictory" of the answerer's position (*Sophistical Refutations* I.2 165b3-4; cf. *Top.* VIII.11 161b19-26. Reasoning can still occur to conclusions undamaging to the answerer, but these are not the aim of the questioner. See *Top.* VIII.6).

There are then, according to the passage above, two primary requirements for the answerer in a dialectical discussion: (1) to submit to reasoning from *endoxa* and (2) to avoid inconsistency. But these requirements are, of course, in potential conflict. Suppose the *endoxa* on the topic under discussion are inconsistent among themselves. As we have noted, the *endoxa* include the views of the majority but also the views of the experts, and Aristotle is well aware that on topics worth discussion the views of these two groups tend to conflict, both with each other and among themselves. (*Top.* I.11) If the answerer is required to submit to *any* valid reasoning from any *endoxa* then his task of avoiding

(16) See above n. 6. The proper translation for *sullogidzesthai* is 'reason syllogistically.' For convenience below I shall often speak of syllogistic reasoning simply as *reasoning*. Inductive reasoning will always be described as such.

inconsistency would seem to be impossibly difficult. By the same token, the task of the questioner would seem trivially easy. What procedure is to be followed, then, in case of conflict among the *endoxa*? Is each party permitted to rely on whatever *consistent* subset of the *endoxa* he may choose? Is the *maximal* consistent set the appropriate one for both parties?

These questions, and others like them, are of special importance for determining what kind of epistemological *justification* for a given claim is provided (for questioner or answerer or both) by a piece of satisfactory dialectical reasoning. If *any* valid reasoning from *endoxa* is satisfactory, even on a topic where the *endoxa* are massively conflicting, then how can dialectical reasoning, whether in the form of a single argument or of an extended chain of connected arguments, reliably provide much at all by way of genuine justification for the acceptance or rejection of belief? Moreover, how could the simple restriction of premises to a *consistent* subset of the *endoxa*, whether the subset be maximal or chosen at will, improve matters on difficult and important topics where conflict among *endoxa* is quite substantial?

These questions and other related ones are now basically ignored in the literature. In order to try to begin to deal with them it will be useful to simplify somewhat our description of dialectic. As we have seen, Aristotle's remarks are typically geared to reflect aspects of a live discussion in a question and answer format between two people. This, of course, reflects the history of the subject. ("Do you call the one who knows how to ask and answer questions anything except a dialectician?" Plato, *Cratylus* 390c). But this is one of the places where it is important to recall that Aristotle's remarks are not "exact" but only "in outline" and as such not always universally applicable to all cases but only to certain typical or paradigm cases. He points out himself in *Topics* VIII.14 (163b3-4) that one can do dialectic *by oneself*, that one person can in effect play both the role of the questioner and of the answerer and produce those results which would come about if there were two parties each doing his job properly. He has in mind particularly there the use of dialectic for mental training (163a29-32; cf. I.2 101a28-30) and the use of dialectic for the scientific purpose of seeing both sides of an issue and thereby being in a better position to discern truth (163b9-12; cf. I.2 101a35-6). But if one can properly do *solo* dialectic for those purposes one can also do it for the other scientific purpose of dealing with the first principles, mentioned at I.2 101a36 ff. So it will be sufficient here, in our attempt to understand dialectical *justification*, to consider the epistemological value of results reached in a way that conforms to the joint requirements which must be met in a two-party dialectical discussion, by *both* questioner and answerer, whether or not there are two actual persons responsible for

those results. This is, of course, important for determining the role and the value of dialectic in Aristotle's methodological procedures in his scientific treatises since there, though he (like Plato in his uses of dialectic in the dialogues) is often engaged in debate with various actual or possible opponents, he (again like Plato) is alone responsible for the proper presentation both of his examination of the opponent and of the presentation of the opponent's position, with whatever resources for defense the latter may involve.

With this in mind, we can begin to see how to deal with the questions posed above concerning the nature and the merits of dialectical justification if we compare with the opening passage of the *Topics* which provoked us to raise these questions, a passage towards the end of the *Sophistical Refutations* which is quite similar to it.

Our purpose was to discover a technique for reasoning about the problem before us starting from things which are as *endoxon* as possible, since this is the business of dialectic in the strict sense and of *peirastic*. But since, on account of its close affinity to *sophistry*, it is set up with an added feature so as to be empowered to conduct testing not merely dialectically but also from the standpoint of one who knows, for this reason we not only undertook the aforesaid business of this study, to discover how to obtain an argument on the basis of what is most *endoxon*, but also to discover how we can defend a position, in the course of submitting to an argument, in a similar manner. We have already given the explanation for this; for this was why Socrates used to ask questions but not to answer them, since he conceded that he did not know anything. (34 183a37 ff)

This new description is, clearly, one which could be of use in answering the main questions raised above. If dialectical reasoning, or a certain type of dialectical reasoning, must be reasoning not simply from *endoxa* but from what is *most endoxon*, or as *endoxon* as possible, then such reasoning cannot be based on just *any* consistent subset of the *endoxa* (even if these *endoxa* are agreeable to questioner and/or answerer). Nor can it simply be based on the maximal consistent subset. Rather it must be based on the *endoxa* which are, in some sense, most *endoxon*, or as *endoxon* as possible, at least on the subject in question. This suggests, for instance, that if the premises of an argument are *endoxa*, and even drawn from the maximal consistent subset of the *endoxa*, but they conflict with other *endoxa* which are *more endoxon* than they are then the argument based on them will not be a proper, or at least not the best, dialectical argument since it is not based on what is most *endoxon* among the relevant *endoxa* on the subject in question. By a natural extension of this one can easily conceive of a dialectical review of all of the problems and questions in a given area as serving to collect together a consistent *body* of information which is *most endoxon* on a given subject such that what is consistent with or supported in an appropriate way by reference to this information is

maximally well justified dialectically. If it could be determined, then, what it is for an item, or a body, of information to be most *endoxon* on a given topic it could be asked what the merits of such a justification are.

5. DIFFERENT FORMS OF DIALECTIC

As an introduction to the exploration of this line of inquiry, it is useful to note that in *Sophistical Refutations* 34 Aristotle's departure from his earlier description, in *Topics* I.1 and again in *Sophistical Refutations* 2, of dialectical reasoning simply as reasoning from *endoxa*, and his new requirement that both questioner and answerer restrict themselves to reasoning from what is *most endoxon* or as *endoxon* as possible, is coupled with a change in the description of the method from "dialectic" (or "dialectical reasoning") to "dialectic in the strict sense and peirastic." (*Sophistical Refutations* 34 183a39 f) This raises the possibility that reasoning from what is *most endoxon* is not required in some kinds or some uses of dialectic but only in others, particularly in the special form of dialectic called peirastic. Peirastic calls for special treatment and it will be studied shortly. But independently of that study it is clear enough from other considerations that not all proper uses of dialectic do require reasoning from what is *most endoxon*, or as *endoxon* as possible. In *Topics* I.2, as we have seen, Aristotle distinguishes the use of dialectic for mental training or gymnastics from other uses. Later in *Topics* VIII.3 he claims that it is *not* required that the answerer in a *gymnastic* dialectical discussion for training purposes only grant as premises things which are "more intelligible" (*gnōrimōtera*) than the conclusion. (159a10-14)¹⁷ All that is required is that the *endoxa* conceded "appear to be true." (159a12)¹⁸ Whether they are more or less intelligible than the conclusion does not matter. In *Topics* VIII.5, however, Aristotle says that in dialectic used for "testing and inquiry" (159a33) it is required that the answerer concede only what is both "more *endoxon*" and "more intelligible" than the conclusion; and he adds that the point of conceding only what is more *endoxon* is that

(17) Aristotle contrasts here procedures for training with those for "learning." Whether the latter is or is not understood here as a species of dialectical procedure requires discussion. (See below n. 21.) This does not matter for present purposes; all that is relevant here is what is *not* required in gymnastic dialectic. The difficult term *gnōrimōteron* is usually translated here 'more intelligible;' the intelligible is not simply what can be understood but what somehow makes sense.

(18) This does not mean that they must be accepted as true by the answerer and/or the questioner. In *Top.* VIII.11 Aristotle points out that in dialectical discussion for "training" one sometimes is required to argue from false premises. But still these premises should be things that "appear so." (*to phainomenon*, 161b4)

this is the way to guarantee that reasoning will only be from what is "more intelligible" than the conclusion. (159b8-9, 13-15; 160a14-16) This shows both that dialectic for gymnastic purposes has different rules than dialectic for "testing and inquiry" (since only the latter need *always* reason from what is "more intelligible") and also that gymnastic dialectic need not always reason from what is "more *endoxon*" (since such reasoning does, and is meant to, guarantee that conclusions *are* derived from what is "more intelligible," and the latter simply does not always happen, or need to happen, in gymnastic dialectic). It is an obvious corollary of this that gymnastic dialectic does not need to proceed from what is "most *endoxon*" or "as *endoxon* as possible." This is clear from the fact that gymnastic dialectic need only reason from "what appears to be true." It may ignore any distinctions within this class between what is more and less *endoxon* and, thus, also what is most *endoxon* or as *endoxon* as possible. Reasoning from premises of the latter sort, then, is restricted to a special type or types of dialectic. What exactly is involved in this procedure?

Aristotle first explicitly introduces the notion that dialectical reasoning, or a type of dialectical reasoning, should be from premises which are "as *endoxon* as possible," in *Topics* VIII.11. There he remarks that "[dialectical] reasoning is not equally *endoxon* and persuasive (*pitthanon*) on all problems." Inquiry on some subjects is more difficult than on others, "so if someone reaches a conclusion from premises which are as *endoxon* as possible [with respect to the problem at hand], then he has done dialectic properly." (161b34-38) Aristotle makes this remark at the conclusion of a discussion of the various ways in which one may criticize a dialectical argument "in itself," as opposed to criticizing the *performance* of those who have produced the argument. (161b19 ff; cf. b38 ff) Since we are here particularly interested in the merits of the arguments themselves this distinction is important for our purposes. One of the grounds for criticism of an argument "in itself" which he emphasizes is, if the reasoning proceeds from premises which are "less *endoxon* than the conclusion" or "more *adoxon* and less credible than the conclusion." (161b28, 30-31) This ground for criticism is, clearly, based on the requirement mentioned above which is laid out earlier in *Topics* VIII.5-6 that, in dialectical "testing and inquiry," correct reasoning must proceed from premises which are "more *endoxon* and more intelligible" than the conclusion. (159b8-9, 13-15, 160a12-16) The above remark (161b34 ff) is introduced as a clarifying addendum to the ground for criticism based on this requirement. (161b30-33) In effect, Aristotle is saying that though correct dialectical reasoning, of a certain type, proceeds from premises which are "more *endoxon*" than the conclusion *how endoxon* they are, within the class of what is more *endoxon*, will depend on the subject at hand. Those *arguments* are

most commendable which proceed from premises which are maximally *endoxon* and (thus) maximally persuasive. But sometimes the best dialectical argument, or arguments, that can be produced for some conclusion, or on some subject, will be ones for which some *person* is to be commended for having done the best that can be done on that subject in the sense that there are no *more endoxon* premises on that subject from which the conclusion follows, and perhaps even no more *endoxon* premises on that subject which conflict with the premises used; but still the *argument* may be less good than some other argument on some other subject which has premises which are, absolutely speaking, more *endoxon*.

The interest of this, for present purposes, is twofold. First, it supports the suggestion that Aristotle's interest, in *Sophistical Refutations* 34, in dialectical argument from what is "as *endoxon* as possible" is an interest in the special type(s) of dialectic (*viz.* non-gymnastic dialectic) in which the premises must be "more *endoxon*" than the conclusion, since that is his interest in the passage where he introduces this notion. Secondly, and more importantly, it shows that Aristotle is prepared to apply two different standards for judging the merits of such dialectical arguments — a personal standard and an impersonal standard. By the personal standard an argument may be *commendable* because it is an argument from what is more *endoxon* than the conclusion, and as much more so as possible given the subject under discussion. Nevertheless, it may be, judged simply as a dialectical *argument* by the impersonal standard, quite weak because its premises are, in an absolute sense, not maximally or highly *endoxon*.

It is in this context that Aristotle makes his often misunderstood remark that:

It is unjust to find fault with those who reach a true conclusion from false premises; for what is false must always be syllogistically inferred from false premises and even what is true can sometimes be syllogistically inferred from false premises. (162a8-11; cf. 161a24 ff, 126b27)

This is not, in Aristotle's view, an unjust criticism of a dialectical argument in its own right. Dialectical arguments *can* be criticized or defused (*luein*) for having false premises (VIII.11 161b21; 10 160b5, 23-39); and a dialectical argument with false premises is a "bad argument." (VIII.11 161b7 with 161a24 ff) It is, sometimes, an unjust criticism of the *performance* of some *person* who has argued from premises which are, though false, as *endoxon* as possible on some difficult and problematic topic. (VIII.11 161b6-8 with a24 ff) But the merits of the performance do not mitigate the demerits of the argument. (b7) So this remark cannot be used, as it often has been, to show that dialectic is an unsuitable procedure to use in the search for truth. To understand how dialectic can be so used, however, our first concern must be to

understand what it is for a dialectical *argument* to be, by the impersonal standard, as commendable as possible. That is, we want to know what it would be for a dialectical argument to be based on premises which are "most *endoxon*" in an absolute sense. As a prelude to this, it will be useful to consider, in more detail than is usual, how a dialectical discussion works to achieve the result that reasoning proceeds from what is most *endoxon*, or as *endoxon* as possible, at least on the subject in question.

6. GIVE AND TAKE IN DIALECTICAL INQUIRY

Sometimes it seems to be supposed that a dialectical discussion is a very formal affair where there is little or no room for give and take. The questioner asks whether the answerer will concede certain premises and the answerer, unless perhaps he has a question about the meaning of a premise, must say simply "yes" or "no."¹⁹ Questioning proceeds until enough concessions are extracted to produce an argument which is then evaluated in isolation from other arguments and claims. Aristotle perhaps gives this impression in *Topics* VIII.7, but it is clear from the surrounding chapters that a dialectical discussion typically involves much more give and take than this. From the consideration of how this give and take normally goes, we can see how a dialectical discussion draws on, or comes to draw on, premises which are "most *endoxon*," on the subject in question.

To begin with, each of the premises necessary for the questioner's proof of his thesis is standardly introduced not simply on its own for acceptance or rejection but as the conclusion of an argument employing induction or analogy or reasoning. (VIII.1, 156a3-11, VIII.8 160a38-9) The main exception to this is in the case of universal premises which "appear thoroughly to be so" (*lian prophaneis*, VIII.1 155b37; cf. VIII.2 158a3-6.)²⁰ If a premise is apparently so beyond any doubt or question then there can be no worries that an answerer will fail to concede it. In other circumstances the situation is different. There an answerer may fail to concede a premise. But if he does so he is not simply expected to say "no." If a general premise is reached by inductive argument based on instances which are "apparently correct" (*phainomena*), then if it is rejected by the answerer an objection (*enstasis*) or counter instance must be provided by him. (VIII.8 160b3-5; cf. VIII.2 157a34 ff; b31-3) However, if the counter instance is a good one, or at least appears to

(19) See Brunschwig (1984/5) p. 33.

(20) Cf. *lian periphaneis*, 158a1. Here we are, no doubt, dealing with what is most *endoxon* in an absolute sense. For further discussion of this see below.

be (160b2), the questioner is not required to simply abandon his general premise. Rather he should qualify it so as to exclude the cases covered by the objection (VIII.2 157b9 ff); unless, possibly, he is able to produce other premises to defeat the objection or support his premises. (VIII.1 156a38 ff; VIII.3 159a4 ff) In either event, nothing prevents the answerer from then introducing new objections, which can be responded to in turn. Sometimes the questioner will aid the answerer, in order to gain his confidence, by bringing objections against some of his own premises. (VIII.1 156b18-20)

In addition to offering counter-examples to defeat inductive arguments for a questioner's premises, an answerer can introduce independent arguments (*anlepicheirein*) against these premises (even after they have been granted and a damaging conclusion has been drawn from them), in order to undermine (*luein*) the conclusion based on them. (VIII.8 160b5-10 with VIII.9-10) Moreover, even if this sort of *lusis* or undermining cannot be provided, an answerer may straightforwardly argue against a conclusion in its own right, where it conflicts appropriately with accepted opinions. (VIII.8 160b6-10) When he produces such arguments, against premise or conclusion, the answerer is, of course, in effect operating as a reasoner, i.e., as a questioner. Given this, there is no reason why his argument, in objection either to premise or conclusion, cannot in turn be objected to by the original questioner who at this point is operating as an answerer.²¹

What rules determine when an objection (*enstasis*) or an undermining (*lusis*) or an attempt at counter-argument (*anlepicheirein*) is a good one in such a give and take discussion for the purpose of inquiry? Clearly enough, the main rule will be the same one which governs all such dialectical reasoning, namely that the argument, if relevant to the matter at hand, must proceed from what is "more *endoxon*" than its conclusion. (VIII.5-6, see the passages quoted in the next paragraph below; 11 161b30-1) This means that if a counter-example is offered to a universal premise it must be more *endoxon* than

that premise; if the counter-example is, in turn, objected to it must be by reference to what is more *endoxon* than it. If a premise or a conclusion is subjected to undermining or counter-argument it must likewise be on the basis of premises which are more *endoxon* than it, and any counter response to this must be based on what is more *endoxon* than these premises. Thus conceived a single dialectical inquiry not only involves an attempt to establish some claim by reference to endoxical premises which are (1) more *endoxon* than that claim, but which are also (2) such that there is nothing more *endoxon* than these premises with which they conflict. Such *endoxon* premises will be relatively more *endoxon* than certain other things but not less *endoxon* (or more *adoxon*) than anything incompatible with them. In that respect these premises can be said to be *dialectically undefeatable*. As such they can be said to belong to what is as *endoxon* as possible or what is *most endoxon*, not simply relative to some particular conclusion drawn from them but also relative to other *endoxa* on the topic which they concern, including any endoxical information in any way relevant to that topic. Given the discussion in *Topics* VIII, there seems little doubt that Aristotle's interest in *Sophistical Refutations* 34 in a method for arguing from what is "as *endoxon* as possible" at least includes an interest in the method for achieving arguments from such premises which he spells out earlier. Nevertheless, as we have seen, Aristotle also supposes that among the dialectically undefeatable premises on different topics some will be in another respect more *endoxon* than others so that the most *endoxon* of all would be a subset of the undefeatable propositions. To see whether Aristotle has any special interest in these propositions in *Sophistical Refutations* 34, and to see further what the epistemological status of this special class of propositions would be, it is necessary now to turn to the crucial question of what it is for one proposition to be more *endoxon* than another.

7. REASONING FROM WHAT IS MOST *ENDOXON*

The main evidence for answering this question is found in *Topics* VIII.5-6. There Aristotle lays down the principles which govern dialectic when used for "testing and inquiry." (159a32 ff) His main general principle there is this:

The one who reasons correctly [as a result of questioning] establishes his set thesis on the basis of things which are more *endoxon* and more intelligible [than the thesis itself]. (159b8-9)

Further on he adds, in the same vein:

The things which are granted [by the answerer] must all be... more *endoxon* than the conclusion, if the less intelligible is to be reached through the more intelligible. (159b13-15)

(21) This elaborate procedure where premises are not simply accepted or rejected but subject to dialectical objection and scrutiny is one which Aristotle says is inappropriate when one is doing dialectic for gymnastic or training purposes. Rather, he says, it is to be used by "one who is trying to learn." (VIII.3 159a4-14 at all) It has been supposed that in saying the latter Aristotle is indicating that this procedure is not to be used in dialectic but only in (non-dialectical) discussion for learning. (See E. Poste, *Aristotle on Fallacies*, 1866, p. 102) But this is impossible. In the passages referred to above, Aristotle clearly has in view the use of this elaborate procedure in dialectic itself. This is one clear indication that Aristotle thinks that a certain kind of dialectical discussion can be used for learning. It is worth noting, however, that this learning procedure is not the one in view at *SE* 2 165b1-3, which Aristotle distinguishes from dialectic, since there the answerer who learns never objects to the questioner/teacher's premises but always accepts them (as Poste sees, p. 102).

And:

The questioner shall complete his reasoning with all those things being conceded to him which are more *endoxon* than his conclusion. Those who try to reason from things which are more *adoxon* (discredited) than the conclusion clearly do not reason properly. Therefore, such things should not be conceded to questioners. (160a12-16)

These passages all confirm that one *endoxon* can be more *endoxon* than another and they suggest what is later confirmed in VIII.11, that the more *endoxon* some claim is the more weight it has in at least one type of dialectic. So the preferred claim, in case of conflict, in dialectic will *always* be the more *endoxon* claim; and the *most* preferred are, thus, the *most endoxa*. Which are these? Our passages here enable us now to answer this question. As we have already noted, Aristotle couples here what is more *endoxon* with what is more intelligible (*gnōrimōteron*); and he claims that "if the less intelligible is to be reached through the more intelligible" then we *must* proceed to the less *endoxon* through the more *endoxon*. This shows that the more *endoxon* beliefs will always be more intelligible than the less *endoxon* beliefs. But more intelligible in what sense? That depends, for one thing, on the type of dialectical inquiry we are pursuing. If the discussion is *ad hominem* and concerns the position of some particular individual who is to be examined from his own point of view, then we are dealing, as dialectic always is, with what is *endoxon*, but only *endoxon* to that individual, and our arguments must be from what is more *endoxon* and hence more intelligible *to that individual*:

If the position in question is *endoxon* or *adoxon* not simply but to the answerer then what ought to be conceded or not is judged by reference to what is held or not held by him. Or if the answerer is set to defend the opinion of someone else, it is clear that each point should be conceded or refused with a view to that person's own mind. (159b25-29)

But dialectical argument need not be *ad hominem* in either of these ways. More often it is based not on the *endoxa* according to some individual but on the *endoxa* without qualification — "the things which are accepted by everyone, or by most people, or by the wise." Here what is *more endoxon* and thus more intelligible must be what is so not in relation to any particular individual but somehow generally. Earlier in the *Topics* (as in various other places) Aristotle describes two general ways in which one thing may be more intelligible than another, in neither of which is a relationship to some special individual (or group) in question. One thing may be more intelligible than another "simply" or "to us."

Thus, *simply*, the prior is more intelligible than the posterior; a point, for example, than a line, a line than a plane, and a plane than a solid; just as a unit is more intelligible than a number — since it is prior to and the basis of every number. Similarly, a letter is more intelligible than a

syllable. However, *to us* it sometimes turns out in reverse. For a solid falls most of all under our perception and a plane more than a line and a line more than a point. For people in general come to know such things earlier, since they can be understood by the ordinary sort of intelligence, the others only by an intelligence which is exact and uncommon. (*Topics* VI.4 141b5-14)

Does proper dialectical argument proceed from what is more intelligible (or what is most intelligible) *simply* or *to us*? Pretty clearly it must be the latter. As we have seen, dialectic is described in the opening sentence of the *Rhetoric* as like rhetoric in drawing on things "which it is in a certain way common to everyone to know." (1354a 2-3) Things which are more intelligible simply, as described above, do not fit such a description. They are intelligible only to an "exact and uncommon intelligence." The things which are most intelligible *simply* include as paradigms the first principles of the sciences as such. (Cf. *Physics* I.1 184a16-23) But these cannot be as such among the most authoritative premises for dialectic. For these need not even be *endoxa*, much less *most endoxa*. They need not be in every case (or any case) known or accepted by appropriate parties. But *endoxa* must be things which are accepted. The implications of this last fact are most clearly brought out in a passage in *Posterior Analytics* I.19:

It is clear that those who are reasoning from the point of view of standing opinion (*kata doxan*), that is only dialectically, should only consider this, whether their argument proceeds from the *most endoxa* premises possible. Thus, although a term is not in truth the middle term between A and B, if it is taken (*dokei*) to be then one who reasons through it has reasoned dialectically. But with a view to truth it is necessary to proceed from what actually holds. (81b18)

As Aristotle makes clear here, proper dialectical reasoning, as reasoning from what is *most endoxon*, need not proceed (in a case where a deductive syllogistic argument is being used), though what is "in truth the middle term." Rather it need only proceed through what is *accepted as* the middle term.²² This is to say, however, that the explanatory relations which actually hold among things need not be reflected in a proper dialectical argument, since an argument through a true middle term is just one which gets these actual explanatory relations right. (*Posterior Analytics* II.2 90a6-7) This shows that it cannot be a requirement of dialectic that its arguments proceed from premises which are more or most intelligible *simply*. For arguments which follow such an arrangement cannot fail to reflect the natural order

(22) For a term to be *accepted as* a middle-term is presumably for it to figure in two *accepted* proposition in the appropriate way and for the syllogistic conclusion from the two propositions to be *accepted as* holding by virtue of the truth of the two propositions. See *APr.* I.1 24b18-22.

of explanation, and so to exhibit true middles, when we are dealing with matters where there is such an order. (*Physics* I.1 184a10-21) Given this, when Aristotle characterizes dialectical reasoning as proceeding from what is more *endoxon* and thus more intelligible he must have in mind what is more *endoxon* and more intelligible "to us." This is confirmed by a passage in *Sophistical Refutations* 33 where Aristotle directly equates what is "held most of all" (*malista dokounta*) with what is "*endoxon* most of all." (182b37-183a4)²³

8. RANK ORDERING AMONG *ENDOXA*

Generally speaking then, those *endoxa* which are most *endoxa* and which, thus, have the most weight or authority are those which have the greatest level of actual (explicit or implicit)²⁴ acceptance. In case of conflict, this is the rule to be used to describe which *endoxa* to retain and which to reject. Given this, it seems likely that the order in which the different types of *endoxa* are introduced in *Topics* I.1 100b21-3 is not accidental. The first type introduced is "the things which are accepted by everyone." These are the things which have, in dialectic, the greatest weight. This is confirmed by the fact that Aristotle treats what is apparent to *everyone* as practically unchallengeable. (*Topics* VIII.1 155b37 with VIII.2 158a1)²⁵

What everyone holds, by way of affirmation or denial, is thus most *endoxon*. Does this put what everyone holds absolutely beyond challenge? Aristotle comes close to saying this but he does not ever quite say it; and clearly he should not say it. Things which everyone holds could be themselves inconsistent. Here a resolution could be reached if among the things which are acceptable to everyone some are

(23) Elsewhere in the *Topics* Aristotle can simply equate what is more intelligible with what "we know better."

"A *proprium* of a thing must be given by reference to what is more intelligible than the thing. For instance, someone who claims that "being most like the soul" is a *proprium* of fire refers to the soul, and this is less intelligible than fire, because we know better what fire is than what the soul is." (V.2 129b9-12)

(24) On implicit beliefs as *endoxa* see Barnes, "Methods of Ethics," p. 501.

(25) Certain passages in the *Ethics*, assuming the method there is dialectical, further confirm this:

"Some object that what everything aims at is not thereby good; but there is nothing at all in what they say. For what is accepted by everyone that, we claim, is so; and one whose purpose is to undermine this conviction will hardly have anything more credible to say." (*Nicomachean Ethics* X.2 1172b35-73a2)

"Is it then practical wisdom which resists [and is overcome in incontinence], since it is the strongest state? That is absurd since the same person will be at once practically wise and incontinent on this view; and not a single person would venture to say that someone who is practically wise is the sort of person who would do the worst things willingly." (*Nicomachean Ethics* VII.2 1146a4-7)

more intelligible to everyone than others and thus more firmly held. These could count as the more *endoxon* (the more noted or accredited) not in extent of acceptance only but in strength of acceptance as well.

In any event, not all *endoxa* are accepted by everyone. The next class which Aristotle lists is "the things which are accepted by most people." These come next, quite clearly, in the hierarchy of what is "more *endoxon* and more intelligible" to us. Here too there can be conflicts needing resolution among beliefs which are equally widely accepted and, thus, here too strength of acceptance as well as extent of acceptance might need to be appealed to.

Next in Aristotle's list of *endoxa* come "the things accepted by the wise." (*sophoi*) Who does he mean by "the wise" here? In some contexts he uses this term to refer to those who actually *have* special know-how or scientific knowledge and understanding. (*Nicomachean Ethics* VI.7 1141a9-20) But he does not use the term in this objective sense here. He substitutes for 'wise' in his discussion 'someone famous as a philosopher' (*Topics* I.11 104b19-20; cf. with 104a8-12 and b31-4); and it is clear that the views of those designated by the latter description are not necessarily for him instances of actual knowledge. As examples he mentions Antisthenes' view that it is impossible to contradict anyone and Melissus' view that being is one (b20-2). So "the wise" here are those who have the recognized *standing* of experts or savants but not necessarily those who are such. (We continue, of course, to use terms such as 'expert' in this way in referring, for example, to "what the experts say.") This makes it clear how the views of "the wise" can count in their own right as noted or esteemed views (*endoxa*) in a way in which the views of individuals with actual wisdom but who are totally unknown could not. The views of recognized experts are those which acquire standing for us in the body of recognized "wisdom." This is also important for understanding how the views of "the wise" can be less authoritative in dialectic than the views of everyone or of most people. That they are less authoritative is further confirmed by Aristotle's discussion in *Topics* I.10-11. Aristotle introduces there the notion of a dialectical premise (*prolasis*), as a proposition which someone could be *prima facie* expected to grant when the question of whether to accept it is raised in dialectical discussion. He describes it as follows:

A dialectical premise (*prolasis*) is a proposition, introduced in the form of a question, which is *endoxos* (esteemed) by everyone or by most people; or by the wise — either all of them, or most, or the most famous, assuming it is not paradoxical;²⁶ for anyone would grant what is accepted by the wise if it is not opposed to general opinion. (I.10 104a8-13)

(26) At 104b24 *enantion tais doxais* is substituted for *paradoxos* (cf. b19). Translators have sometimes used 'contrary to general opinion' or the like to translate

Here Aristotle makes it clear that in dialectic it is not to be expected that an opinion of recognized experts will be granted when it conflicts with dominant majority opinion. (Cf. *Politics* III.11 1282a15 ff) Thus, such an opinion does not count as a premise for a dialectical argument. This fits with what we would expect given that dialectical argument has to proceed from what is more credible to and intelligible to us. We readily credit the recognized views of experts on matters where we have no independent opinion of our own. There the views of recognized experts are the most widely recognized and credited, and thus the most intelligible to us, of available views. Where experts have views which conflict with our own preponderant view, however, their views are not the most widely credited and intelligible to us of those available. Thus they have less authority in dialectic where this is the standard in play. Of course, the view of an expert still counts by definition as an *endoxon* (100b21-3), even if it is contrary to the majority view. How then does it enter in as an item with some weight in dialectical discussion if it cannot serve directly as a premise? Won't an answerer always be entitled to reject it out of hand since it conflicts with the more *endoxon* majority view? Aristotle's practice does not fit with such an approach; and his theory in the *Topics* shows how the views of experts even when they conflict with and are on their own less *endoxon* and less intelligible than majority views, can be introduced and even successfully defended in dialectic. An expert view which conflicts with majority views is called by Aristotle a *thesis*.

A *thesis* is a view which is paradoxical, held by someone famous as a philosopher... Or a *thesis* may be a view opposed to received opinions for which we have a reasonable argument; for instance the view maintained by the sophists that not everything that exists has either come to be or is eternal. For the cultured person who is literate exists though he has not come to be and is not eternal... This view, even if it does not seem [on its own] true to someone, might well seem so because of the supporting argument. (104b19-28)

This passage indicates how a view which is, on its own, contrary to general opinion can acquire standing in dialectical discussion. It can be introduced by use of an argument which shows that it follows from what we would generally accept. Aristotle does not explicitly apply this point to the views of philosophers here, but the context suggests that he has this in mind; and he typically thinks of philosophers, or equivalently "the wise" (*sophoi*, 104b33), as those who

paradoxos. This has the strong authority of 104a8-12 behind it, and that passage at least indicates that this describes a clear case of a *paradoxos* view for Aristotle and the case which is relevant for the characterization of a dialectical *prolasis*. But 104b31-34 suggests (with b19-28) that a *paradoxos* view of an expert may also be one which conflicts with the received view of the (other) experts, where there is no conflict with general opinion.

offer reasons and explanations for what they claim. (*Metaph.* I.1-2 981a24 ff, 982b11 ff; *SE* 1 164a11-28, 165a19-28) Certain passages in the *Ethics* confirm this connection.

It is perhaps rather pointless to examine all views; it is sufficient to examine those which are most prevalent or those which are taken to be supported by some reasonable argument. (I.4 1095a28)

Of the two types of views which Aristotle counts as worth considering here the minority views held by experts would belong to the second; and later at 1098b27-8 he redescribes the two types of views which he has proceeded to consider as those either of many people or of the renowned. From this it is easy to see how special expert views contrary to more widely accepted or majority views can be taken seriously and even established in dialectic without contravening the general rule that what is credited by and more intelligible to most people takes precedence over the views of the wise. If the expert views can be seen to *follow from* universal or majority views then they acquire the authority of those views and so can pose a challenge to other (less *endoxon*) majority views.

Where there is no dominant majority view on some subject, however, the views of the wise are, as we have seen, the most authoritative just on their own. It is of interest that Aristotle gives no special weight at this juncture to the opinions of a bare majority. The opinions of most people (*hoi pleistoi*) or of the general community (*hoi polloi*) outweigh the contrary views of experts (104a8-13), but the opinions of a bare or small majority do not. This is intelligible in the light of Aristotle's general scheme. Dominant community views will be widely credited by us, but where there is a close division among community views, Aristotle supposes we are likely to credit the "wisdom" of the experts rather than the views of a small general majority.

The views of the wise can also conflict with each other. In introducing the views of the wise in his list of the types of *endoxa*, Aristotle mentions first the views of all the wise, then those of most, then those of the most famous and distinguished. Is this also a ranking in order of greater to lesser authority? Are we to understand Aristotle as saying that if the experts do not all agree then we should rely on the view of most of the experts, and if there is no substantial majority view only then should we prefer the views of the most famous and distinguished to those of other experts? Though Aristotle says nothing explicit on the point, this would make sense given his general approach. He says, as we have seen, that we follow the practice of relying on established expert views where we have developed no relevant common views of our own. But if we have developed no views on our own and we are thus in the position of having come to rely on

recognized expert views as the ones we most credit it makes sense that the view on a given topic held by most experts would be the one which has achieved the greatest renown and credit by us. If, however, there is no dominant view of the experts (again a *bare* majority counts for nothing), then it makes sense that we should go with "the most famous and distinguished." That is, we should go with the experts whose views have received the greatest recognition *from us*. (The word translated 'distinguished' is *endoxoi*, 100b23.) This again seems the best we can do if we are relying on what is most well-accredited by us. However, in all these cases as in the earlier ones, it would, of course, be possible to over-ride the *prima facie* order of authority by appeal to a supporting argument for some claim where the premises of that argument belong to a more authoritative category than the claim.

If this account is correct then the initial order in which Aristotle lists the types of *endoxa* is not accidental. He moves in his list in order from the (*prima facie*) more to the (*prima facie*) less authoritative types of *endoxa*.

9. DIALECTIC AND PEIRASTIC IN SCIENTIFIC INQUIRY

We are in a position now to raise pointedly the main question raised earlier: Why does Aristotle think it is necessary in scientific inquiry to use dialectic? Consider the recommendation he gives to the inquiring dialectician. As we can see now, in effect it comes to this: Base what you say, if you can, on what everyone accepts; failing that, appeal to what the dominant majority think. If there is no dominant majority view appeal to the view of the experts. If the experts do not agree, appeal to the dominant majority of the experts. If there is no dominant majority view among experts appeal to the view of the most famous and distinguished experts. This sounds like appropriate advice for the adman trying to maximize sales or the politician trying to maximize support for his policies, but hardly for a scientist. That is to say it seems to embody a procedure for justification which is designed to be maximally effective in producing conviction when used with people in general. This is, of course, just what is to be expected since, as we have already noted, Aristotle thinks of dialectic as like rhetoric in focussing its appeal on what everyone is maximally ready to understand and accept. But the aims of science are different. The scientist's results can, Aristotle says, only be grasped by "an intelligence which is exact and uncommon." (*Topics* VI.4 141b13-14) So why should science have any interest at all in procedures for justification best designed to produce maximal understanding and conviction in people in general?

In attempting to answer this question it is important to try to determine just how it is, on Aristotle's own theory of dialectic in the

Topics, that dialectic *does* play its *necessary* role in scientific inquiry mentioned in *Topics* I. (I.2 101a36 ff) Writers have standardly supposed that Aristotle simply does not say anything further about this in the *Topics*. Some have even suggested that this is an indication that the method of the *Topics* itself is not one which Aristotle in fact conceives of as appropriate for use for the scientific purposes mentioned, but only for use in school gymnastics.²⁷ It is, however, a mistake to think that Aristotle says nothing further about this matter. In what *we* call the *Topics* he does not elaborate on his claim that it is necessary to use dialectic to reach the first principles of the sciences. (He comments, very briefly, in *Topics* VIII.14 163b9 ff, only on the other scientific use mentioned in I.2 101a34-36.) But in what *we* call the *Sophistical Refutations*, which is clearly a part of the *Topics*,²⁸ he is particularly interested to describe a special form of dialectic which he calls peirastic (*peirastikē*) or the art of testing. Peirastic is introduced as a method for reasoning from "what is necessarily known by anyone who professes to have *epistēmē*" (i.e., technical or scientific knowledge, *SE* 2 165b5-6). Later it is described as a procedure which, though it does not require *epistēmē* and can be used even by the unlearned, nevertheless can be used to test the claims of all those who profess *epistēmē* in whatever subject (*SE* 11 172a17-32). In *Topics* I.2 Aristotle justifies his claim that the use of dialectic is necessary to reach scientific first principles on the specific ground that dialectic is "capable of examination" (*exelastikē*, 101b3). The two words *peirastikē* and *exelastikē*, here translated 'testing' and 'examination,' are derived from roots which overlap in meaning in Greek and, though *peirastikē* is a technical term, various cognate forms of the two words are used interchangeably by Aristotle (as they are by Plato) in his general descriptions of dialectical procedure. (*Rhet.* I.1 1354a5, *Top.* VIII.5 159a25, 33; cf. Plato, *Apol.* 22e-23c, *Prot.* 348a) If Aristotle had used *peirastikē*, or some cognate word, instead of *exelastikē*, in *Topics* I.2, then the material in the *Sophistical Refutations* would long ago have been thoroughly studied to understand Aristotle's famous doctrine in *Topics* I.2. But it would appear that little attention has been paid to the apparent connection between the *Topics* passage and the later material up to now.

10. SOME MAIN FEATURES OF PEIRASTIC

What is peirastic and how does it serve to examine or test claims to scientific knowledge? Aristotle describes peirastic as "a part of

(27) See Brunschwig (1984/5) p. 34. Cf. Ross, *Aristotle*, p. 57.

(28) The evidence for this is conveniently assembled by Brunschwig, *Aristotle: Topiques*, I (1967) p. xix.

dialectic" and "a type of dialectic." (SE 8 169b25; 11 171b4-5; cf. 9 170b8-11) Thus, like all dialectical arguments, peirastic arguments employ *endoxa* as premises. (SE 2 165b3-4) They must, however, also satisfy certain stronger requirements. Aristotle initially defines peirastic arguments as those whose premises are "things which are held by the answerer and which are necessarily known by anyone who professes to have *epistēmē*." (SE 2 165b4-6) Some have claimed that this explicitly distinguishes peirastic arguments from dialectical arguments and contradicts Aristotle's later claim mentioned above, that peirastic is one *parl* or *lype* of dialectic.²⁹ As we shall shortly see, there is no inconsistency. As Aristotle understands these initial requirements for peirastic any premises which satisfy them are guaranteed to be *endoxa* and, thus, premises for dialectical arguments, albeit of a special type.

To better understand what peirastic arguments involve, it is worth looking closely now at the passages in *Sophistical Refutations* 11 where Aristotle introduces the important claim that the dialectician who is doing *peirastic* does his testing on the basis of a certain kind of knowledge. He describes this knowledge there as knowledge of what is "common" (*koina*). The dialectician who does peirastic is, in fact, identified at the beginning of that chapter as the one "who takes into account the common things as they relate to the matter at hand." (171b6) These common things are described in the chapter as things such that "the one who does not know them necessarily does not possess [scientific] knowledge." (172a26-27) This description clearly reintroduces a feature of one of the special requirements for *peirastic* dialectical premises introduced in Chapter 2 (that they are necessarily known by the professing scientist) and thus it makes it clear that these common things are the actual premises involved in doing peirastic. Aristotle

(29) W. D. Ross, *Aristotle's Metaphysics*, 1924, v. 1 p. 260 f., C. Kirwan, *Aristotle's Metaphysics* IV-VI, 1971, pp. 84-5, P. Moraux "La joute dialectique d'après le huitième livre des *Topiques*" in *Aristotle on Dialectic*, G. E. L. Owen (ed.) 1968, pp. 288-9 n. 3, followed by Brunschwig (1984/5), p. 35. These writers also charge Aristotle with a further inconsistency, that of describing peirastic sometimes not as a part of dialectic, or as distinct from dialectic but as identical to dialectic. This charge is based in part on Aristotle's use in *Topics* VIII.5 of the term *peira*, trial or testing, in describing dialectic quite generally. But the term *peira*, like the verb *peiran*, is an ordinary Greek word used in Plato, Aristotle, and elsewhere to denote any kind of trial or testing, including any type of dialectical examination. The term *peirastikē*, by contrast, is a philosopher's term of art, not used even by Plato and introduced with a technical definition by Aristotle in SE 2. There is no reason to suppose that any example of dialectic which Aristotle would describe as *peira* must fit the technical requirements of *peirastikē*. Secondly, these writers claim that at SE 11 172a21, Aristotle says that dialectic "is *peirastikē*." But this just means, in context, that it is *dialectic* which is capable of peirastic testing not some special *epistēmē*. This does not mean that *everything* that dialectic does is peirastic, only that peirastic is a capacity of dialectic. Cf. 171b9 (with b4-5) and *Metaph.* 1004b22-26, where the same point is made.

further describes the common things which peirastic dialectic uses in the following way:

Peirastic is not the scientific knowledge (*epistēmē*) of any definite subject. Thus it may deal with every subject. For each of the arts employs some common things (*koina*) so that everyone, even the unlearned, makes use of dialectic as peirastic in some fashion. For everyone attempts to test those who profess knowledge, on a limited basis, and this basis is the common things; because people know these things themselves no less than those who profess knowledge even if they seem to say quite inaccurate things. So they all practice refutation since they practice an unskilled form of the activity which dialectic practices with skill, while the dialectician is the one who does peirastic by use of an *art* of reasoning. (172a27-36)

What are these "common" things which everyone knows? One possibility, accepted by some interpreters, is that they are what Aristotle elsewhere calls the "common notions" or "common axioms" — the principles which hold true for all subject matters. (*APo.* I.10 76b11 ff; *Melaph.* II.2 996b26 ff) In fact, on one manuscript tradition, the one preferred by recent editors, Aristotle goes on immediately to characterize these "common" things as "identical principles which hold true of everything." (172a36-7) This is a natural reading in view of the fact that Aristotle contrasts these things with others which are "unique" (*idia*) to a given subject matter and such as to determine "a distinct nature and kind" (*phusin tina kai genos*, 172a37-8). This is just the kind of language which Aristotle uses elsewhere to contrast the common axioms with the other first principles special to each science. (*APo.* I.10 76a37 ff, 76b11 ff) But this cannot be what Aristotle means here. For one thing, Aristotle emphasizes the point that only "*some* common things" are employed by each art. (172a29-30) So he does not mean that they all hold true of everything. In addition, if he did mean this, we would be faced with the bizarre consequence that the peirastic dialectician only examines or refutes claims by testing whether they fit with the common axioms — that is, principles such as the law of non-contradiction, the axiom of equals and the like. But Aristotle permits peirastic dialectical argument to proceed from any relevant *endoxa* not just from common axioms. He gives various examples in the *Sophistical Refutations* of such arguments. Earlier in Chapter 11, for example, he offers the following example of an argument which appeals to something "common."

Take the case where someone denies that it is better to take a walk after dinner [rather than before dinner] and gives as his reason Zeno's argument [that motion is impossible]. This is not a medical argument since the argument employs what is common. (172a8-9)

The argument mentioned here is in Aristotle's view an eristical or sophistical argument, not a dialectical argument. (See 172a2 ff) But it is like peirastic dialectical arguments, he says, in appealing to what is

common. And in this case the common things are clearly not true or applicable in all subjects, but rather include, in the case of Zeno's argument, such common and well known information as: To go a certain distance you must first go half-way. One might suppose that such information must at least be applicable in a number of areas, but this would, again, exclude from the dialectician's premises numerous relevant *endoxa*. Aristotle himself calls it common because it is not "based on first principles which are unique" to the specific subject at hand, i.e., medicine, but rather on matters which can be adapted for use "against people in general who do not know what is possible and impossible in the subject at hand; since it will apply with such people." (172a4-7) He later explains why the common things can be so used with people in general: "because people know these things themselves no less than the scientist." (172a33-4) Here Aristotle opposes what is common to what is used in argument from proper first principles (i.e., in demonstrations) with those who have special scientific knowledge of those principles and describes it as what can be used specifically by and with all people who may lack such special knowledge, but nevertheless know these things. A similar contrast to this one is drawn earlier in *Sophistical Refutations* 9. There Aristotle distinguishes scientists who can produce or evaluate refutations based on the first principles (*archai*) of a given science i.e., refutations by *demonstration* (170a20-34; 36-38); from dialecticians, who produce refutations based on "the common sources of argument for each art and discipline" (170a34-36) and examine refutations "which do not fall under any particular art" (i.e. are not demonstrative in character) but are "based on the common things," i.e., on the premises for proofs from *endoxa* (*endoxoi syllogismoi*) on any given subject (170a38-b1). These common premises which determine the dialectician's province are clearly not restricted to propositions which hold good of all, or many, subject matters but include any appropriate and relevant *endoxa*.

This use of the term 'common' is found in the opening lines of the *Rhetoric* where it is specifically used to describe dialectic in both its questioning and answering modes. The passage is worth repeating.

Rhetoric is a partner of dialectic. For both of them are concerned with the sorts of things which it is in a certain way common to everyone to know and which require no specialized knowledge. Thus everyone in a certain way takes part in both dialectic and rhetoric. For everyone on a limited basis engages in examination and in submitting to argument; and also in defending himself and in accusing others. (1354a1-6)

Another passage, a few paragraphs later, develops this point:

In dealing with certain people, even if we possessed the most accurate knowledge (*epistēmē*), it would not be easy to persuade them by arguments based on this knowledge. For argument according to knowledge (*epistēmē*) is instruction (*didaskalia*), and this is impossible in this

case. Rather it is necessary to construct our proofs and arguments by use of the common things (*koina*), just as we said in the *Topics* about ordinary discussions (*enteuxeis*) with people in general. (1355a24-29)

In the discussion of *enteuxeis* to which Aristotle refers, in *Topics* I.2, he does not use the term *koina* but rather, as parallel to it, "the opinions of people in general." (*tas tōn pollōn doxas*, 101a31) So it is certain common opinions, whether they hold true of one or many or all subjects which constitute the "common" things as they are understood here.

The language of these passages in the *Rhetoric* so closely parallels that in the *Sophistical Refutations* that there seems little doubt that the thought of the two is essentially the same. So the term 'common' in these passages does not designate what is metaphysically common, i.e., true of or applicable to all or many subjects, but rather what is epistemically common, i.e., what is intelligible even to common people, those without specialized knowledge of principles.

Given this, it seems clear that we should not follow recent editors in accepting the manuscript tradition on which Aristotle describes the common things which dialectic reasons from as "identical principles which are true of everything." Rather, we should prefer the alternate manuscript tradition on which Aristotle says simply that "there are many of these [common] things in each area... so that it is possible on the basis of these things to engage in peirastic testing on every subject." (172a36-9) On this reading, Aristotle makes it clear that peirastic will pay special attention to those commonly understood things that hold true in the particular area under investigation. When he goes on to contrast the whole class of common things with things which are "proper" (*idia*) to a given area (172a38) he does not mean that *particular* common things do not specially concern some particular area but only that *collectively* the common things are not connected with "a distinct nature and kind (*genos*)." (a37-38) This is how he argues that peirastic (and eristic) argument cannot be demonstration, from "first principles" (172b1-4), since this would require that the common things *do* collectively determine a distinct kind.³⁰

(30) The popularity of the alternate manuscript reading is no doubt influenced by the fact that in certain passages, such as *Rhetoric* I.2 1358a1 ff, Aristotle draws a contrast between those dialectical or rhetorical arguments which draw on material which may be applied in common (*koinon*, 1358a12) to all or many subjects and those which draw on matters which are unique (*idia*, a17) to a particular subject. But this is not the same contrast as the one which Aristotle draws in the above passages. In the above passages Aristotle uses the term *koina* ("the common things") to describe and delimit the materials for dialectical, or peirastic, reasoning quite generally. In *Rhetoric* I.2 1358a1 ff, by contrast, the term is used to refer only to one type of basis for a rhetorical or dialectical syllogism by contrast with another (a10-21, cf. I.3 1359a16-26). In fact, Aristotle claims there that most rhetorical syllogisms are based not on the *koina*, as he uses that term there,

It is easy enough to see now why it is that peirastic arguments always count as dialectical arguments, as those two types of arguments are defined in *Sophistical Refutations* 2. The premises of peirastic arguments are the "common" things, things which are generally accepted and, indeed, things which everyone *knows*, both the learned and the unlearned (172a27-36). Thus, the premises of peirastic arguments are *endoxa*, by the definition of that term in *Topics* I.1. More than that, since *everyone* accepts them, they are "most *endoxon*" or "as *endoxon* as possible" in the absolute sense. This explains why Aristotle, in *Sophistical Refutations* 2, can say that the questioners' premises in peirastic arguments must be "believed by the answerer," when this is not all a requirement of dialectic in general. Everyone accepts the premises of peirastic arguments. It also explains why, in Chapter 34, he can show a special interest in *peirastic* as a procedure in which both questioner and answerer proceed from what is "most *endoxon*" or "as *endoxon* as possible." Peirastic is, without qualification, a procedure of that sort.

As we noted earlier, Aristotle takes it that one can legitimately criticize a dialectical argument not only where the premises are not *endoxa*, or where they are less *endoxon* than the conclusion, but also where the premises are false. (*Topics* VIII.11 161b19 ff at b21; 12 162b14. The criticism can be overridden where the argument is used as a *reductio* to establish the falsity of a premise 162b16-22) It is clear that Aristotle understands all of these modes of criticism as evaluations of an argument as a piece of dialectic, not from some external non-dialectical perspective. But it is a general puzzle how dialectic, which Aristotle always characterizes as proceeding from the point of view of standing opinion (*kala doxan*) rather than from the point of view of truth (*kal' alētheian*), can be in a position to evaluate premises as true or false. (*Top.* I.14 105b30-31, *APo.* I.19 81b18-23) Since Aristotle describes *peirastic* dialectic as proceeding from what everyone *knows* and what even professing scientists *must know*, it is clear that for peirastic at least there must be some way of guaranteeing that its premises are *true*. If we can understand how this is accomplished this may contribute to the resolution of the general puzzle.

There is one further important description in *Sophistical Refutations* 11 of the common things which are known and understood by all and so serve to make genuine peirastic dialectical examination possible. To show why peirastic dialectic "is not the same sort of thing

but on things which are special to the subject at hand. (1358a26-28; cf. III.22 1395b30-96b18) In *SE* 9 and 11, however, all peirastic examination is based on *koina*, as the term is used there. (170a34-b1; 171b4-7, 172a27-b1) So the two uses of the term are quite different.

as geometry but is rather an art one may possess even without having specific (scientific) knowledge" (172a22-3), Aristotle offers the following argument.

It is possible even for someone who does not know the subject [scientifically] to test another who does not know the subject, providing that the latter grants things not based on what he knows [scientifically] or, in particular, on the special principles of the subject, but on things which are consequent on [the special principles] which are such that, though knowing them does not prevent one from not knowing the discipline, still one who does not know them necessarily does not know it. (172a23-27)

What are these things different from but "consequent on" (*ta hepomena*) the special principles of a science or other discipline such that in order to know the science or discipline you *must* know them as well as the special principles? In the case of a science, the answer is clear; they must be the things explained by the special principles, the objects of the "knowledge *that*" which precedes the "knowledge *why*" provided by the principles. (*APo.* II. 1-2) This is all that the scientist needs to know in addition to the principles to have full knowledge of the science and these things are, of course, in a very straightforward sense "consequent on" the special principles.

If this is correct then it is quite easy to see how *peirastic* dialectic can play a crucial role in the process of discovery and justification in science. If the "common" things, the special set of generally known *endoxa*, which peirastic dialectic argues from do make up at least some of the things which *must* be explained by the principles of a science then one can easily see how they can be used to rule out any proposed theories which are incompatible with them and how dialectical inquiry in a given area could serve to collect them together as a necessary prelude to the search for correct explanatory theories. But, as we have seen, these common things, the things which peirastic dialectic particularly argues from, are described not only as things consequent on the special principles of a science but also, later in *Sophistical Refutations* 34, as things which are "most *endoxon*." How can it be that there is this correspondence among these classes? Why should what is most *endoxon* turn out to constitute at least a part of what we must be able to explain by appropriate scientific principles? And why should either of these things be what is *known* by any scientist or commonly *known* (the *koina*) on the topic in question and thus true?

11. DIALECTIC IN SCIENCE: A STANDARD VIEW

At this point, it will be useful to consider the few attempts which have been made in the literature to say what it is that makes dialectic suitable as a procedure for justification in science or elsewhere, to see

what they may offer in answer to these questions. One approach is suggested in the influential work done by G. E. L. Owen on Aristotle's method of dialectic. Owen did not attempt to work out in any general or detailed way what the epistemological value is of the appeal to *endoxa*. But he did argue that an appeal to *endoxa* or *legomena* (the things which are said) "may be an appeal either to common belief about matters of fact (e.g. *EN* I.11 1101a22-24) or to established forms of language (e.g. *ibid.* VII.1. 1145b19-20; 2 1146b4-5) or to a philosophical thesis claiming the factual virtues of the first and the analytic certainty of the second (e.g. *ibid.* I.8 1098b12-18)."³¹ Owen did not elaborate on what the "factual virtues" of "common belief about matters of fact" might be for Aristotle. But he suggests here that the epistemological value of the appeal to "established forms of language" derives from the fact that they have "analytic certainty." In the same vein, Owen argues that when, for example, Aristotle argues dialectically in the *Ethics* against the suggestion that practical wisdom can be coupled with incontinence on the ground that 'no one would say this' (1146a6), what he is asserting is "not that it happens to be false but that given the established use of the words it is absurd." He claims further that in his discussion of incontinence, Aristotle appeals to certain *endoxa* in order "to show *a priori* that there is no use for the expression 'doing what is wrong in the full knowledge of what is right in the given circumstances'."³² Owen does not elaborate on these claims at any length; and it would be easy, in the light of current doubts about the coherence of the analytic-synthetic distinction and its value for epistemology, to ignore his proposals. After all, there is no direct evidence that Aristotle recognized a class of analytic statements. He has no term for our 'analytic,' and he never explicitly attempts to justify belief in any class of statements on the ground that they hold simply in virtue of linguistic conventions which fix the meanings of terms and so can be known *a priori*. But there are various reasons why the suggestion deserves consideration that appeal to *endoxa* is epistemically significant, in some cases at least, because the *endoxa* reflect established forms of language and are thereby analytic and known *a priori* with certainty.³³ If it were the case that peirastic dialect in particular did argue from analytic premises which reflect *a priori* conventions of

(31) G. E. L. Owen, "Tithenai ta Phainomena," p. 117.

(32) P. 115.

(33) Owen also makes the claim that "*endoxa* rest on experience even if they misrepresent it. If they did not Aristotle could find no place for them in his epistemology." (p. 117) He does not explain, however, what it is for *endoxa* to "rest" on experience. If this is to be compatible with his claim that *endoxa* are often analytic and known *a priori*, it presumably cannot mean that all *endoxa* depend evidentially on or are known by experience.

language that would in fact explain certain things that Aristotle says about *peirastic*. It would explain why the premises of *peirastic* argument are commonly known and accepted by everyone, and also why they are true and thus capable of being used to decisively refute proposed scientific principles which are incompatible with them. However, it would not explain one other crucial claim that Aristotle makes about *peirastic* premises, namely that they are things which are "consequent on" and explained by the relevant scientific principles. Why should the *analytic* truths have this status?

It might be suggested in defense of Owen on this point that Aristotle wants to argue that the body of common or accredited opinion on a subject fixes the reference of the name of the subject in such a way that it is a logical presupposition of successful reference to that subject that most, and the most intelligible parts to us, of that body of opinion are not false of that subject or, more strongly, are explained by the basic principles of that subject.³⁴ In his own discussions of reference Aristotle does suppose that there is *some* most intelligible opinion which at least sometimes has this kind of reference fixing status, namely the opinion expressed in the "account of what the name signifies."³⁵ Interestingly enough, this type of opinion *can* play for Aristotle the role of being one which appropriate theoretical principles must explain on pain of failure of reference and hence failure of truth for those principles. To take a familiar example from *Posterior Analytics* II.8-10, Aristotle supposes that our belief that 'thunder is a certain noise in the clouds' serves as the belief by grasp of which our thought is fixed on to the real thing thunder in such a way that that fact must be true, and explained by the fundamental principles of meteorology. (93a21-9 with 94a7-9) A similar example from *Parts of Animals* II.3 explicitly employs semantic terminology.

It is clear that blood is hot in the following way, namely as something in the being of blood. Blood is said to be hot in the same way as something would be if we were to signify by its name that it is seething hot water. But blood is not hot in respect of its permanent substance (*hupokeimenon*). So in one way it is hot essentially (*kath' hauto*) in another way it is not. For heat belongs in our account of it in the way in

(34) M. Nussbaum apparently has in mind a version of this line in saying that the ultimate justification for the appeal to *endoxa* or appearances is that only within the circle of appearances can we "refer" at all. (*The Fragility of Goodness*, 1986, p. 257.) See below for further discussion of her views.

(35) *APo.* II.10 93b30. Various different accounts have been offered in the literature of what sort of form and content this crucial reference fixing opinion has in Aristotle's theory. For discussion see R. Bolton, "Essentialism and Semantic Theory in Aristotle," *Phil. Rev.* 1976. The differences among these accounts do not affect the point in question here.

which white belongs in our account of the white man; but insofar as blood takes on heat as an accidental affection (*pathos*),³⁶ it is not essentially hot. (649b21-27, cf. 649a13-20)

Here Aristotle makes it clear again that in the account of what we signify by a name a certain group of the features which we take to belong to what the name denotes will be included. He also makes it clear that the features which are included in the account of what we signify by a name may be features naturally present and whose presence is explicable. For instance, the mention of heat is included in the account of what *we signify* by the name 'blood,' even though heat is not a part of the fundamental essence of blood. Nevertheless blood is naturally heated up, particularly by the heart, in the course of its production for the sake of nourishment and growth, and it is in looking for the explanation of this that we find the real nature of blood. (650a2 ff, *Juv. et Sen.* 469b12 ff)

This provides a good illustration of how Aristotle's scientific inquiries standardly focus on looking for explanations for opinions with this kind of reference fixing status. But it offers only limited support for Owen's proposal at best, even putting aside the question whether these opinions count for Aristotle as items of *a priori* knowledge. Since Aristotle only gives such reference fixing status to single select opinions on a given subject, and never to the body of accredited opinion, or of most accredited opinion, as a whole, the role in justification which he accords to peirastic premises in general cannot be explained along these lines.

Related problems arise from the fact that the appeals to "established forms of language" which Owen himself cites from the *Ethics*, do not seem to introduce analytic theses. The first of these is: "People are incontinent in respect of pride and honor and gain." The second is: "Some people are incontinent without qualification." In neither case does Aristotle regard the fact that "we say" these things as guaranteeing without further argument that they are so. He takes it as necessary to justify this pair of related theses (in *Nicomachean Ethics* VII.4) and his justification for them does not draw solely on premises which are based on established forms of language. The justification depends crucially on the claim that some things that are a source of pleasure are necessary for life — such as food and drink; some are desirable for their own sake but not necessities — such as honor. (1146b23 ff) On the basis of this he justifies the view that incontinence in respect of honor occurs and also the view that incontinence without any added qualification occurs (when a desire for some necessity overmasters a judgment of what is best). But this basis for Aristotle's

(36) See *GC* I.4 319b8 ff on the relation between *hupokeimenon* and *pathos*.

argument is hardly analytic. Nor does Aristotle try "to show *a priori*," as Owen claims, that no one can do what is wrong "in the full knowledge of what is right in the given circumstances." In the familiar passage to which Owen refers Aristotle does claim that for the *incontinent person* to know in this way "would be astonishing" (*thaumaston*, 1147a9) or "would be taken to be strange" (*deinon* 1146b35). But this does not establish that Aristotle takes it to be evident *a priori* that the incontinent person does not know that he is doing what is wrong in this way. For one thing, Aristotle knows that strange and astonishing things do turn out to be true (e.g., that the diagonal of a square is incommensurable with the side, *Metaphysics* I.2 983a15-17).³⁷ More importantly, he takes it as necessary to argue for another account of the knowledge which the incontinent person has as an alternative to this one and, more significantly, to argue against attempts to defend the astonishing result. In both cases the argument depends clearly on a *posteriori* matters of fact. In the former case (1147a11-18) Aristotle appeals to what "we see" in the case of people who are asleep, mad or drunk. In the latter case his argument continues as follows:

The fact that someone [who is incontinent] makes claims from his own knowledge is no indication [that he is genuinely activating this knowledge]; for those who are in such conditions [of being asleep, mad, or drunk — which are like incontinence] even recite scientific demonstrations and verses of Empedocles. (1147a18-20)

Here Aristotle evidently uses a claim which he has just established — namely that the effect of strong appetites on knowledge in the incontinent person is on a part with the effect of strong drink on knowledge in those who are drunk — to undermine a powerful argument designed to show that incontinent people do sometimes fully well know that what they are doing is wrong. This argument is that they sometimes openly and correctly *say* such things as: "I *know* what I'm doing is wrong."³⁸ Aristotle's reply is in effect this: "Saying correctly that one knows something, even with apparent conviction, is no sure indication of genuine activation of one's knowledge of that fact in case one is asleep, mad, or drunk. In such a state saying something

(37) See the passages in Bonitz, *Index*, under *thaumadzein*.

(38) Aristotle's phraseology here is unusual — *legein tous logous tous apo tēs epistēmēs*. (1147a18-19) This means at least that the claims about good and bad which incontinent people make may express knowledge which they actually have, as in the use of *apo epistēmēs* at *Metaphysics* I.4 985a16. But the emphasis in the added use of the article *tēs* — "from *his* knowledge" — suggests that the understood verb with this phrase is not simply *gignesthai* (come) but rather a verb such as *lambanesthai* (are taken) which would indicate that Aristotle has in mind the affirmation of certain things selected by the incontinent person *as* things which are known. In this event Aristotle is addressing himself to a tougher objection to his own view than is usually supposed.

coherent with conviction is not even a sign of genuinely understanding what one is saying. And incontinence is like these states."

This argument is clearly not *a priori*. It is based on, among other things, an appeal to our common experiences when asleep or drunk. But the argument is a crucial part of Aristotle's defense of the claim that the incontinent person does not operate "in the full knowledge of what is right in the given circumstances." This makes it quite unlikely that Aristotle intended to defend this claim on *a priori* grounds.

It is however true, as Owen claims, that Aristotle does dismiss the suggestion that practical wisdom can be coupled with incontinence with the retort: "That is absurd... not a single person would venture to say [that]." (1146a5-7) But does Aristotle think it absurd simply in view of linguistic conventions or "the established use of the words," as Owen says? Aristotle's own appeal here is in effect to the fact that absolutely everyone would reject the claim with the strongest conviction. He introduces no further qualifications. This would, however, be an adequate basis for rejecting the claim out of hand, as Aristotle does, if on the rules of the method which he is using here the strongest basis for rejecting (or accepting) some thesis is simply and without further qualification that it would be unequivocally rejected (or accepted) by everyone. This, as we have seen, is just what the rules of dialectic and *peirastic* require. Given this, it seems that Aristotle is here simply making a standard dialectical move without illuminating what it is that provides the ultimate epistemic backing for such a move.

12. REVISION OF THE STANDARD VIEW

As noted above, the current philosophical climate is less hospitable now than it was when Owen wrote to appeals to what is analytic and know *a priori* on that ground; and this has led to greater caution in attributing appeals to the analytic to historical figures. So it is perhaps unsurprising that more recent writers working within Owen's framework have shifted ground somewhat and argued that while the force of dialectical argument does not depend ultimately on the appeal to what is analytic and in that way absolutely *a priori*, it may involve an appeal to what is *a priori* in a different way.

The suggestion has recently been made in various quarters that the value of the appeal to *endoxa* derives from the fact that the *endoxa* for Aristotle are not to be understood as a set of convictions which may or may not correspond to some belief-independent objective reality where independent evidence may be sought for their truth or falsity. "Aristotle does not make the clean separation between evidence and

opinion on which this [position] presumes." The *endoxa* are, rather, a set of convictions which, at least when properly refined, "hang together to constitute a world" in such a way that, ultimately, the accord of any beliefs with these convictions is "criterial of their truth."³⁹ A typical development of this approach begins with the suggestion that, for Aristotle, the *endoxa* are simply one sub-class of the *phainomena* (the appearances) where the *phainomena* are to be understood as constituting the world as it exists for us. The *phainomena*, so understood, may of course conflict but in resolving any conflicts, on this view, we must square our results with the *phainomena* and show that these results preserve the *phainomena* as true, or at least that the greatest number and the most basic are preserved. In deciding which are most basic or authoritative, on this proposal, Aristotle considers our actual practices in justification to see, in different areas, what judges we in fact rely on. This reliance, however, does not itself require further justification for him. The reason for this is that "appearances and truth are not opposed, as Plato believed they were. We can have truth only *inside* the circle of appearances, because only there can we communicate, even refer, at all." This does not absolutely prohibit the introduction of new views but it does require that any new view draw on and preserve beliefs which are "deeper" than the ones which the new view forces us to give up — deeper in that "the cost of giving them up would be greater, or one we are less inclined to pay." Given this, we can see how certain *endoxa*, those which are deepest or most *endoxon*, can be in a way *a priori*, by being "unrevisable, relative to a certain body of knowledge" or even so basic that they "cannot significantly be questioned at all from within the appearances, that is

(39) The quoted phrases are from M. Burnyeat, "Good Repute," J. McDowell, "The Role of *Eudaimonia* in Aristotle's Ethics" (in *Essays on Aristotle's Ethics*, ed. A. Rorty, p. 372) and M. Nussbaum, *The Fragility of Goodness*, p. 242. The description of the development of this position is mainly drawn from Nussbaum (pp. 240-258). A similar, though not obviously identical, development is suggested by Burnyeat and by McDowell's discussion (pp. 369-373). McDowell's remarks are, however, made in the course of reflections on Aristotle's method in ethics, and it is not clear that he would take them to apply in other areas. Burnyeat and Nussbaum take the method to be universally applicable for Aristotle. In T. Irwin, *Aristotle's First Principles*, it is argued that in his later scientific works (including the *Metaphysics* and *De Anima*) Aristotle introduces a new form of "strong dialectic" which draws on *endoxa* which are known *a priori* in a Kantian sense. They are not constitutive of reality but necessary preconditions of the possibility of knowledge (or significant thought) about reality. Since Irwin, unlike other writers, is not trying to account for the role of dialectic in science, as dialectic is understood and described in the *Organon*, but only as dialectic is later used (but never described), his views require separate treatment. Reasons for doubting that Aristotle introduces in the *Metaphysics* a new form of dialectic, or uses a form which appeals to this sort of *a priori* knowledge, are given in "Aristotle's Conception of Metaphysics as a Science" (forthcoming).

to say the lives and practices of human beings, as long as human beings are anything like us."⁴⁰

In considering the merits of this type of view it is important to keep in mind that, as developed in the literature, the view is not always explicitly offered as an account of why it is that the method of dialectic, or its *peirastic* part, is a useful and necessary tool to use in science or elsewhere but as an account of Aristotle's views on the proper method for the justification of belief quite generally. If the proper method is taken to be dialectic then these will, of course, come to the same thing. But even if it is not, in crucial respects the rules of the method as described here coincide with the rules of the method of dialectic and *peirastic* as we have seen it laid out by Aristotle in the *Topics* and elsewhere. In particular, the rule that where the things which are apparent to us conflict we are to prefer the ones which reflect what we as a group are more inclined, or more strongly inclined, to accept is just the main rule of dialectical method as a tool for inquiry. *Peirastic* in particular argues exclusively from what is most *endoxon* in an absolute sense, i.e., what is most apparent to us. So if the justification offered for this procedure were indeed Aristotle's then that would enable us to see what the basis was for his confidence in dialectical method and in *peirastic* in particular.

This view has many of the same advantages in accounting for what Aristotle says about dialectic and, in particular, *peirastic* as those listed earlier for Owen's view. If *peirastic* argues ultimately from premises which are constitutive of reality and impossible for us to intelligibly question, then that would explain why its premises are true and known and accepted (at least implicitly) by everyone. Moreover, these advantages are achieved on this view, without the difficulties which come with the introduction of the notion of analyticity in interpreting Aristotle. However, the view would still not account for how it is that the premises of *peirastic* in particular are consequent on, and explained by, the first principles of the various sciences.

In addition to this, there are reasons for doubting whether this is an adequate account of Aristotle's views on method quite generally. To begin with, there are the two respects noted earlier in which Aristotle's views on method *in science* go counter to the main rule given above. Aristotle takes it that in science the data of perception *always* take precedence over *endoxa* without reference to how widely held or how deeply entrenched those *endoxa* are.⁴¹ Secondly, he holds that

(40) Nussbaum, pp. 257-8, 254.

(41) Nussbaum (pp. 268, 274, n. 21) takes the perceptual *phainomena* to be one subset of the *phainomena*, understood in general as what *we* think or what *we* say. But there is no reason to suppose that whatever careful observers perceive, as Aristotle understands this in passages such as *APr* I.30, is always something that *we* believe or say.

there is a procedure for the justification of first principles in science which goes beyond the matter of their ability to preserve or their inferability from what is *most* *endoxon*. In general, his doctrine is that such principles must exhibit and conform to what is most intelligible simply or by nature *by contrast with* what is most intelligible to us. This requires, as is reflected in his discussion of *peirastic*, that these principles must be capable of *explaining* the appropriate *endoxa* on some subject rather than simply preserving them or being coherent with or derivable from them. In addition, these principles must be capable of explaining the relevant perceptual data whether these count as *endoxa*, or what is most *endoxon* or apparent to us, or not.

It may be responded to this that the main rule as described above can accommodate these points.⁴² First, it can accommodate the idea that in science perceptual *phainomena* always take precedence over *endoxa* if one of the things that is most apparent and *endoxon* to us just is the rule that in science perceptual data always take precedence over *endoxa*. Against this suggestion, however, a number of things can be said. To begin with, when he says we must give the top preference to perceptual data in science, Aristotle does not say or suggest that the reason for this is that people in general adopt this rule. Moreover, Aristotle nowhere says or suggests that people in general in his day even held such a rule. This rule was almost certainly only held by a very small minority of philosophers and scientists at best,⁴³ and it seems unlikely that people in general held any clear views on scientific method in Aristotle's day. Science was after all a quite new affair and the vast majority of people were no doubt entirely without views on the matter of scientific method. Aristotle does claim, as we have seen, that people in general go with the experts where they have no contrary views of their own. But if most experts on scientific method rejected Aristotle's principle in his own day it follows that from the point of view of the judges we trust or what is acceptable "to us" Aristotle should have rejected it. Another, deeper, question is how such a rule could ever be one which it was rational to adopt given Aristotle's general view on the proposal in question here. On the main rule proposed, Aristotle's view is not that we should follow the *rules* of method which are apparent, or most apparent, to us, but that we should follow *whatever* is overall most apparent to us with no special standing given to rules of method as such. Given this general principle how could we, or Aristotle, ever adopt the specific rule that in determining what should be accepted in

(42) Cf. Nussbaum pp. 248-50.

(43) We do not know of any Pythagorean or Eleatic or Platonist, or of any Atomist or other post-eleatic pluralist who held this view. Certain medical writers may have held a view like this but they constituted a small minority among theorists on scientific method.

science, perceptual data *always* take precedence over other appearances? On the general rule, the alternate specific rule that we should accept what scientists say, including their perceptual reports, where and only where it is compelling in the light of the total scheme of what is apparent to us overall, is clearly a preferable rule. But if so, then there is no way on this proposal, of justifying the specific rule which Aristotle adopts — *always* to prefer perceptual data in determining what counts in science no matter what trouble this creates for our system of beliefs overall.

It is if anything more difficult on the proposed general rule to see how to accommodate the specific rule that when it comes to scientific principles what is more intelligible *simply*, that is what explains the appropriate perceptual data (whether these are *endoxa* or not), takes priority over what is more intelligible *to us*. The general rule is in effect that what takes precedence is *always* what is more intelligible *to us*. How could it be that on the basis of this we decide to adopt the rule that for scientific principles what is less intelligible to us but more intelligible simply is to be preferred, or the rule that for scientific principles whether they are *endoxa* or not is irrelevant? (*Posterior Analytics* I.6 74b21-26) It might be replied that this is in fact the way we do find it more intelligible to view scientific principles even when these principles conflict with other things that are more intelligible to us. But this is not in fact Aristotle's own view. As we have seen, he supposes that people in general are prepared to find special scientific views acceptable *only* when they do *not* conflict with other generally held views of whatever sort. Given this there is no way for him, or for us as he describes us, to move from the principle that we should always prefer what is more intelligible to us to the rule that in our scientific principles we should always prefer what is less intelligible to us but more intelligible absolutely. Even if the rule to prefer *in science* what is more intelligible simply to what is more intelligible to us is one acceptable "to us" if some *specific* scientific principle turns out to be less acceptable to us overall than something which conflicts with it that we accept, we could not accept that principle, on the general rule, even if we accepted the suggested rule of *scientific* method.

Given these difficulties it is apparent that we cannot use the proposal offered to try to show what the value of dialectic, and in particular of *peirastic*, is for Aristotle. On this proposal, Aristotle regards the appeal to what is most apparent or most *endoxon* as ultimately an appeal to what fixes the limits of what is intelligible for us and thus cannot intelligibly be questioned or challenged. *Peirastic* is based on the appeal to what is most intelligible to us. But since we have seen that Aristotle does not in fact view even what is most intelligible to us as ever, *for that reason*, beyond question or challenge by

reference to perceptual data or to what is less intelligible to us but more intelligible absolutely, this will not help us to see what the epistemological basis of dialectic, or its value for science, is.

13. DIALECTIC IN SCIENCE: THE TRADITIONAL VIEW

By contrast with these recent approaches, which see dialectic as drawing on the *a priori*, the most frequent traditional point of departure on this topic has been the group of passages where Aristotle talks about the relation between *endoxa*, or common opinions in general, and truth.

The capacity to grasp the truth is the same as the capacity to grasp what is like the truth. At the same time, people have an adequate natural inclination toward the truth and so they turn out to attain truth for the most part. Thus, the one who can aim skillfully [in argument] in relation to the truth is equally able to aim skillfully [in argument] in relation to the *endoxa*. (*Rhetoric* I.1 1355a14-18)

The study of the truth is difficult in one way but easy in another. An indication of this is the fact that while no individual can adequately attain it still we do not all collectively fail. Rather each person has something of value to say about the world and, though individually he contributes little or nothing to the truth, out of the assembly of all something significant arises. Thus, insofar as the truth seems like the proverbial door which no one can miss, in this way the study will be easy. That we can have some grasp of the whole and not be able to grasp some part shows the difficulty of it. (*Metaphysics* II.1 993a30-b7)

Some of these views [about happiness] are voiced by many and from long ago, others by a few renowned men; and it is reasonable that neither group is entirely mistaken, but right on at least one point if not most. (*Nicomachean Ethics* I.8 1098b27-9)

In all these matters we should try to get conviction through argument using the things which are apparently the case (*ta phainomena*) as evidence and as illustrations. For it is best if everyone is seen to be in agreement with what we are going to say, or if not that all should agree in some way. (This they will do when their views are modified.) For everyone has something of his own to contribute to the truth, and it is from this that we must give some proof of what we say. For from the things which are said correctly but not clearly what is clear will be reached by those who advance, if at every stage they exchange things which are more intelligible for the jumble of customary assertions. (*Eudemian Ethics* I.1 1216b26-35)

These passages have been the ones most often referred to in attempts to account for Aristotle's confidence in the method of dialectic.⁴⁴ In the first of these passages Aristotle offers the rather optimistic view that people in general have a natural propensity toward

(44) See, among others, G. Grote, *Aristotle* (2nd edn., 1880) p. 273; W. F. R. Hardie, *Aristotle's Ethical Theory* (1968) p. 38, Barnes, "Methods of Ethics," pp. 506 ff.

the truth which results for the most part in the attainment of truth. Variants on this theme are found in the subsequent passages. These passages do not, of course, show (against what was argued earlier) that Aristotle thinks that the method of dialectic or peirastic is on its own *sufficient* for reaching final results in science or elsewhere. In the first passage Aristotle claims only that *endoxa* are for the most part true, and he explicitly points out in the second and third passages that while in some general way or on some point people may have made substantial progress toward the truth, in some particular area or on various other points they may have got nowhere at all. (Cf. *Metaphysics* VIII.3 1029b3 ff, *Politics* III.11 1281b15-21, 35-39) Nothing here conflicts with the point that new perceptual data which are not *endoxa* can have higher epistemic standing than *endoxa*. Still, if it is the case that where people do have views those views are likely to amount to something, that might seem to offer a basis for using dialectic and peirastic as a *part* at least of one's standard method of inquiry. But do these passages even provide an adequate justification for that? For one thing, since Aristotle allows that at some times and in some areas the *endoxa* will not be reflective of truth, it seems that he must accept the conclusion that, sometimes, dialectic will not be useful in some specific scientific or other inquiry. But, if not, then does he have a way of telling us when it is useful and when not? In addition, these passages indicate why Aristotle might have thought it valuable to consider received views on some topic but what guidance do they offer on how to proceed when the received views conflict, as they often do? In particular how can they explain why one might want to place *more* weight on views which are more *endoxon* and more familiar *to us*? Since this is the way dialectic and, in particular, peirastic proceeds if these passages do nothing to explain this they do not show why in science (or elsewhere) we should make use of dialectic or, more specifically, of peirastic.

The standard discussions of these passages do not address these problems and questions. Recent writers, in particular, have tried to deal only with the more limited question of why it is, in Aristotle's view, that people more often than not come to hold true beliefs. The answer which they have offered is that, for Aristotle, (1) human beings are *by nature* intelligent or inclined toward the truth and thus naturally capable of coming to true beliefs. In addition, for Aristotle (2) nature does nothing in vain, i.e., *natural* capacities have a purpose which is for the most part realized — in this case the acquisition of truth. So (3) people for the most part come to true beliefs.⁴⁵ Whatever the merits of this argument, it does not tell us how to proceed when people's views

(45) See Barnes, *ibid.*

conflict, so it does not help to justify the dialectical, or peirastical, way of proceeding in such cases.⁴⁶ But what can we learn from the argument itself?

Those who have offered this argument on Aristotle's behalf have been careful to point out that Aristotle himself does not use this argument, and to claim only that he is committed to its premises. The first question then is whether Aristotle is actually committed to the premises? He commits himself to the first premise of the argument, as well as to the conclusion, in the passage from the *Rhetoric* quoted above. But what of the second premise? Does Aristotle believe that natural capacities or inclinations are for the most part realized in the manner required here? That is not clear. Stones have the natural capacity to fall toward the center of the earth. But does this mean that all or most stones at some time actually realize this capacity? No, since certain conditions must be met for the capacity to be realized (e.g., a stone must be placed in a medium less dense than it to fall) and it is not clear that these conditions are at some time met, or that Aristotle thinks that they are, for all or most stones. (*Physics* II.8 199b18, 26; *Metaphysics* IX.5 1047b39 ff, 7, 1048b37 ff) This point can be urged even more strongly for the case of intelligence since intelligence is, for Aristotle, not merely a natural capacity but a "rational capacity," i.e., one which it is within the power of an agent to exercise *or not* depending on, among many other types of conditions, the agent's overall motivational state. (*Metaphysics* IX.5; cf. *On Dreams* 2 460b11 ff)

So Aristotle cannot, and would not, accept the generalization, in premise 2 above, that natural capacities, including intelligence, are for the most part realized, in the way required for reaching his conclusion. He would feel obliged to show that the appropriate conditions, motivational and otherwise, are met in a way adequate for bridging the gap between the first premise and the conclusion. If we can understand how he would do this then we can perhaps understand how he would deal with the questions and problems for his views and

(46) J. Cooper (review of *The Fragility of Goodness*, *Philosophical Review* 1988, pp. 553-4) has argued that "it stands to reason" from Aristotle's perspective that those who seem to be acute and who exercise their intelligence more, namely "the wise", are more likely to come to the truth than ordinary people. Thus for Aristotle their views are preferable in case of conflict. (Cf. p. 551) However, this is not Aristotle's own rule in peirastic, or dialectic generally; if it were dialectic would lose its required effectiveness with people in general. (*Top.* I.10 104a11-12) Moreover, in fact, as Aristotle knows, the special views of "the wise" tend to be massively conflicting. This means that the views of the wise cannot in fact be for the most part true but rather are mainly false. Since Aristotle never says without qualification that they are mostly true but only says this about the views of people in general, we lack the necessary support for attributing to him the (implausible) doctrine that the views of the wise are more often, or more nearly, true than the common views of people in general.

how he would defend his claim that dialectic and in particular peirastic is necessary in scientific inquiry.

14. DIALECTICAL JUSTIFICATION IN SCIENCE

The beginnings of an approach to this matter are to be found in Aristotle's remarks in the passage from the *Eudemian Ethics* quoted above. (I.6 1216b26-35) In that passage, Aristotle introduces an elaborate justification for a certain methodological recommendation. The recommendation is that it is desirable to get conviction (*pistis*) in a way that relies on appeal to the *phainomena* or what appears so to us. His reason for that is that if we proceed in this way then our results will be in agreement with what everyone holds, either simply or "when their views are modified." The reason which he offers to explain why it is desirable to be in agreement with what everyone holds is that everyone has something to contribute to the truth to such an extent that "we *must* give some proof of what we say" by reference to people's opinions, at least when they are properly modified. Aristotle does not say how he supposes this "modification" should take place. But the rarely used word which he employs here (*metabibadzein*) is prominently used also in the *Topics* to describe the dialectical procedure of revising views by reference to what is "more *endoxon*" or "as *endoxon* as possible." (VIII.11 161a33-37, with b34-38 and VIII.5-6) Since the procedure which Aristotle is describing here also involves reasoning from what enjoys the maximum consensus, it is likely that this is what he has in mind.

Here, then, Aristotle explicitly introduces the claim we have been trying to understand, the claim that it is not simply a desirable or useful point of method to appeal to the common opinions, or the most common opinions, on a topic but necessary. He goes on to give the reason why this is so. His reason is that by proceeding in this way we guarantee that we move from what is correct though somehow unclear and jumbled up to what is clear and more intelligible and, so he must be supposing, it is necessary that we proceed in this way.

What exactly is this way of proceeding? Why is it necessary? And how does proof by reference to what everyone holds play a role in this procedure? The doctrine which Aristotle develops here is expressed in quite similar language elsewhere, notably in the methodological passage with which he opens his *Physics* and in a related passage in *Metaphysics* VII.3.

The natural procedure is to go from things which are more intelligible and clearer to us to things which are clearer and more intelligible by nature. For what is intelligible to us is not the same as what is intelligible

simply. Therefore, it is necessary to proceed in this manner: from what is less clear by nature, though more clear to us, to what is clearer and more intelligible by nature. The things which are evident and clear to us, in the first instance, are things which are rather jumbled up. Later, from them, their elements become known and the principles serve to separate these [jumbled up] things. That is why it is necessary to proceed from the comprehensive to specifics; for the whole is more intelligible in relation to perception and the comprehensive is a sort of whole, since it embraces many things as parts. (*Physics* I.1 184a16-26)

It is advantageous to progress in stages to what is more intelligible, since for everyone learning proceeds in this way — through things which are less intelligible by nature to things which are more intelligible. Just as in the area of action our task is to start from what is good to each individual and make what is good altogether good to each, so it is our task to start from what is more intelligible to oneself and make what is more intelligible by nature intelligible to oneself. Now what is intelligible and fundamental to individuals is often barely intelligible and encompasses little or nothing of the reality of the thing in question. But nevertheless, one must try to understand the things which are altogether intelligible by starting from things which are hardly intelligible but intelligible to oneself and progressing, as we have said, through these very things. (*Metaphysics* VII.3 1029b3-12)

In these passages Aristotle begins by asserting, as he does in the *Eudemian Ethics* passage, that we must proceed by starting from what is more intelligible to us and moving to what is more intelligible simply. The initial reason which he evidently offers for this, particularly in the *Metaphysics* passage, is the rather obvious one that we cannot start anywhere else than with what we understand. This by itself does nothing to answer the question as to why we are required, as the *Eudemian Ethics* says, to give some kind of *proof* of our final theoretical results, which may not be intelligible "to us," *by reference* to what is most intelligible to us. This question is particularly pointed in view of the claim in the *Metaphysics* passage that what is intelligible to any given individual may have little or nothing to do with the reality of the things in question. Aristotle does, however, go on to indicate in the *Physics* why we need to provide such a proof. He supposes that the elements and first principles which are the things most intelligible by nature are the elements and principles of the wholes which are most intelligible to us. This is to say that the data which make up what is most intelligible to us must on the whole be *explained by* the things which are more intelligible simply. This is the view we found also in the passage in the *Sophistical Refutations* where Aristotle characterizes the things in some area of scientific inquiry which are "common," i.e. commonly known and accepted, and thus used by peirastic, as "the things which are consequent on" the special principles of the subject. (II.172a29-34 with a23-27) If this is so then it is easy to see why, as the *Eudemian Ethics* says, there must be a kind of proof of the principles by reference to common opinions and why he characterizes these opinions,

in the *Eudemian Ethics*, as correct. But why do the principles *have* to be principles of and hence to explain such data. Why cannot *most* of our common opinions on some subject, including *most* of the ones which are most intelligible to us (and thus most *endoxon*), simply be wrong and thus not in need of explanation by any theoretical principles?

The reason which Aristotle goes on to offer in the *Physics* passage quoted above in defense of his claim that what is most intelligible to us must be explained by appropriate principles is that these opinions accord with "what is more intelligible in relation to perception."

This fits with a claim which Aristotle repeats elsewhere:

At different times different things are more intelligible to the same people — in the beginning the objects of perception, but as their knowledge becomes more accurate, the reverse. (*Topics* VI.4 142a2 ff)

I mean by what is prior and more intelligible to us what is closer to perception, by what is prior and more intelligible simply I mean what is further from perception. The things which are furthest from perception are, most of all, universals; the things which are closest are particulars; and these are opposite to each other. (*APo.* I.2 72a1 ff)

What is most intelligible to us, Aristotle thinks, always coincides with what is not closely related to what we perceive. Elsewhere he is quite explicit that the fact that all or most people accept something "gives it credibility as something based on experience."⁴⁷ He specifically says in the *Physics* that this is *why* first principles must account for what is more intelligible to us.

If this is so then we can explain what the value of peirastic dialectic is for science in the following way. We have seen that peirastic dialectic is a procedure for the testing of claims by reference to what is most *endoxon* and most intelligible to us. *As such*, in Aristotle's view, it is a procedure for the testing of claims by reference to those beliefs which we have which are most closely connected with information which we have acquired by perception and for the rejection of whatever claims may conflict with this information. So *peirastic* dialectic, in effect, turns out to be a procedure which draws on the information which we as a group are now warranted in accepting on the basis of what is most obvious to us from perception. This explains how Aristotle can describe peirastic as drawing on what everyone knows and how dialectic, in certain forms, can draw on what may reasonably be claimed to be true. This also provides a clear role for dialectic in scientific inquiry understood in the way in which Aristotle standardly understands it in passages such as *Prior Analytics* I.30, namely as a procedure which starts from the data of experience and proceeds to find principles which conform to and *explain* such data. It enables us to coherently integrate

(47) *Div. in Som.* 462b14-16.

Aristotle's remarks about the need for dialectic in science with what he says in these passages. It also shows why dialectic has the limits which we have seen it has in scientific inquiry. Peirastic draws on what is in conformity with the most empirically well-justified information that *as a group* we have *up to now*. But further observation by the individual scientist or others may yield *new* empirical data which show that some theory which is most empirically well-confirmed for us now, because it offers us the best explanation for the empirical data which we have amassed up to now, is wrong. This may occur whether or not these new data are or come to be *endoxa* or generally known, i.e. a basis for further dialectical or peirastic argument. This explains why Aristotle can say that in science we must try to account for the *endoxa* but also suppose that perceptual observations take precedence over *endoxa* in validating theories.

This account of the value of dialectic also explains why dialectic cannot by itself provide us with adequate theoretical principles. It serves to draw on and thus aid us in collecting the empirically most well-confirmed data which theoretical principles must serve to explain. But by itself it cannot determine the principles which do the explaining. This is why, nevertheless, it plays a necessary role in finding those principles. Since it serves to collect the most empirically well-justified information that we as a group have now it plays an essential role in our search here and now for first principles. For the best we can do here and now in our search for first principles is to find those candidates for first principles which, among other things, do the best job of explaining the empirically most well-confirmed information that we have now.

15. THE MERITS OF PEIRASTIC JUSTIFICATION

On the account which we have now reached of the epistemological basis of peirastic dialectic that method turns out not to embody any general appeal to what is *a priori*. Nor does it embody, despite certain appearances to the contrary, a strong coherence procedure for the justification of belief. A belief is not justified in peirastic dialectic simply when it coheres well with the maximal consistent body of existing belief or anything of the sort. Peirastic dialectical justification, for a given belief does depend on whether that belief can be ultimately defended by reference to those beliefs which are "most *endoxon*" i.e., most widely and firmly accepted by us. But even here it is not *because* those beliefs are most widely and firmly accepted by us that the belief in question is justified by reference to them. Rather it is because those beliefs bear a special relation to the data of

experience. Peirastic dialectical justification, for Aristotle, like justification in science simply, turns out to give special priority (though not precisely the same priority) to the evidence of experience. This does not mean, however, that perceptual judgments are, for Aristotle, incorrigible. Though this is not the place for a full treatment of his views on this subject, it is clear enough that he does not take ordinary perceptual judgments to be in principle or in general unrevisable. (*De Anima* III.3 428b18-25) This is compatible, however, with his general assignment of final epistemic authority in science to perceptual over theoretical beliefs. (*De Caelo* III.7 306a13-7) In peirastic dialectic this result also holds. It follows from the doctrine that revision must always be made by reference to what is most intelligible to us, together with the doctrine that what is most intelligible to us is always closest to perception. In this respect there is a kind of foundationalist empiricist element in Aristotle's theory of justification both in science and in peirastic dialectic generally.⁴⁸

This result raises a number of interesting questions. Perhaps the most important are these: How would Aristotle try to show that the more widely and firmly accepted something is the more likely it is to directly embody information acquired by perception? And, how would Aristotle justify the reliance which he places in "the testimony of the senses?" To answer these questions, and other related ones, would require us to go into Aristotle's rather complex views on information acquisition; and this is not the place for that. Here it must suffice for us to see that, recent claims to the contrary notwithstanding, the old cliché that Aristotle is fundamentally an *empiricist* is, after all, in certain respects basically right.⁴⁹

(48) There is not space here to consider the role of non-peirastic forms of dialectic in science. Aristotle is clear that peirastic is the form of dialectic which is especially relevant in scientific, or other philosophical, inquiry. (*Metaph.* IV.2 1004b25-26, quoted above at the beginning) The account developed here can be extended to cover the other forms.

(49) This is an extensively revised version of the paper presented at the conference on the Ile d'Oléron. The excellent penetrating comments of Jacques Brunschwig and Daniel Devereux on the original version served as the main stimulus for the revisions. They have led me to minimize discussion of controversial points whose defense is inessential to my main proposals. Brunschwig also kindly gave me at the conference a copy of his valuable paper (see n. 5) which I had not seen before; so I have rectified my failure to consider it earlier.

REMARQUES SUR LA COMMUNICATION DE ROBERT BOLTON

JACQUES BRUNSCHWIG

Robert Bolton avait présenté, au Colloque d'Oléron, une première version de l'étude magistrale dont on vient de lire la version définitive. C'est naturellement sur la base de la première version que j'avais rédigé les quelques commentaires qu'il m'avait été demandé de présenter moi-même au Colloque, pour servir d'introduction à la discussion générale. Ces commentaires comportaient, selon la loi du genre, quelques critiques et objections, portant sur des passages précis du texte de Bolton. Daniel Devereux, de son côté, présentait ses propres observations sur le même texte, observations dont la convergence avec les miennes était remarquable, et parfois même surprenante.

La version définitive du texte de Bolton, ici imprimée, n'a pu m'être communiquée qu'assez récemment. Elle est encore plus riche et plus développée que la version initiale, et à beaucoup d'égards, elle en est profondément différente. Je disposais d'un temps limité pour réviser mon propre texte; il m'a fallu déjà réserver une bonne partie de ce temps pour repérer exactement les transformations de toutes sortes que l'auteur avait effectuées sur son texte initial. Ces transformations sont, d'ailleurs, extraordinairement minutieuses et méditées; et ce fut un privilège de pouvoir les observer de près. Mais il m'aurait fallu plus de temps encore pour adapter mes commentaires initiaux, de façon tout à fait appropriée, à un texte si soigneusement retravaillé.

En étudiant avec tout le soin possible ce fruit des amours de Macintosh et de Pénélope, j'ai pu faire, pour ce qui me concernait personnellement, deux constatations principales. D'une part, la quasi-totalité des passages (qu'ils fussent longs ou brefs) de la première version qui avaient fait l'objet de diverses objections de ma part ont purement et simplement disparu de la version finale, et ils ont été remplacés par des développements entièrement nouveaux. D'autre part, une bonne

part des adjonctions que le texte a reçues contiennent diverses critiques qui me sont nommément adressées, à propos d'un petit article que j'ai consacré, il y a quelque temps, aux *Topiques* d'Aristote («Aristotle on Arguments without Winners or Losers», in *Wissenschaftskolleg zu Berlin — Jahrbuch 1984/1985*), article dont il n'avait pas été question, sinon très allusivement, dans les débats d'Oléron.

Pour désencombrer d'emblée la discussion de toute dimension agonistique, je voudrais d'abord dire quelques mots au sujet de cet article. Je n'ai nulle envie de me laisser entraîner à défendre ici un petit texte dans lequel je n'ai pas mis de grandes prétentions, et qui mérite sans nul doute quelques-unes des critiques précises que m'adresse Robert Bolton à son sujet (je veux parler de celles contenues dans sa note 6, où se trouve résolu très habilement, du même coup, un problème difficile). Je suis moins d'accord, bien sûr, avec la présentation générale qu'il donne de cet article ; elle fait silence sur les précautions que j'avais prises pour y délimiter expressément mon sujet. Mais ce n'est pas ici le lieu d'en débattre. Il n'y a pas de raison, me semble-t-il, pour que la discussion se déplace sur un texte dont le lecteur ne dispose pas, et dont le propos ne recoupe que marginalement le problème qui fait l'objet essentiel de l'étude de Robert Bolton.

En revanche, il peut valoir la peine de suivre, au moins sur quelques points, les effets de nos discussions d'Oléron, et c'est ce que je vais essayer de faire ici.

Observons d'abord, pour fixer le cadre de la discussion, que l'on peut distinguer, dans l'étude de Bolton, et d'après ses propres indications, une question centrale et une question préalable. La question centrale est celle-ci : quel est le rôle joué par la méthode dialectique, chez Aristote, dans l'acquisition et dans la justification des résultats qu'il présente dans ses ouvrages scientifiques et philosophiques, et surtout, quelle est pour lui la justification épistémologique de ce rôle ? La question préalable est celle-ci : qu'est-ce que c'est au juste que la méthode dialectique en question ? Non sans raison, Bolton soutient que la diversité considérable des réponses apportées jusqu'à présent à la première question, la question centrale, rend éminemment souhaitable une reprise attentive de la seconde question, la question préalable. Notons que le corpus pertinent n'est pas le même pour les deux questions : la question centrale implique une enquête à travers les indications méthodologiques contenues dans tous les traités aristotéliens, alors que la question préalable porte essentiellement sur l'interprétation de ce que Bolton appelle le «traité officiel d'Aristote sur la dialectique», à savoir les *Topiques*, au sens étroit du terme (sans les *Réfutations sophistiques*) ou au sens large (avec les *Réfutations*). Notons aussi que l'articulation des deux questions peut soulever d'assez nombreux problèmes : il n'est pas évident, ni hors de toute contestation,

que les procédures qui, dans les traités scientifiques et philosophiques d'Aristote, peuvent être qualifiées de «dialectiques» relèvent toutes d'une seule et même «méthode dialectique» ; il n'est pas évident non plus que cette «méthode dialectique», au cas où l'on en admettrait l'unicité, soit identique à celle qui est présentée théoriquement, et enseignée pratiquement, dans les *Topiques*.

Mes commentaires initiaux, dans ce qu'ils avaient de critique, ne portaient pas, pour la plupart, sur les thèses développées par Bolton à propos de sa question centrale. Ils concernaient presque exclusivement la question préalable. Sous ce rapport, je l'ai dit, la nouvelle version de son texte me donne entière satisfaction, et je ne puis que remercier Robert Bolton d'avoir bien voulu prendre si soigneusement mes remarques en considération. Les sections 2, 4-6 et 9-10, qui constituent dans la nouvelle version l'essentiel du traitement de la question préalable, ont été totalement ou largement réécrites, et la plupart de mes objections initiales ne s'appliquent plus du tout à elles.

On me pardonnera, je l'espère, d'avoir été particulièrement attentif à ces sections nouvelles du texte qui, au moins implicitement, répondent et réagissent à mes remarques. Quelques difficultés y subsistent, à mon sens, que l'on peut considérer comme des vestiges, plus ou moins réformés ou transformés, des difficultés qui m'étaient apparues initialement. Elles peuvent constituer la matière d'une nouvelle discussion. J'examinerai donc successivement (et très sélectivement si l'on considère la multiplicité et l'ampleur des questions soulevées par l'étude de Robert Bolton) quelques thèmes qui, par eux-mêmes aussi bien que dans l'interprétation construite par mon interlocuteur, apparaissent comme étroitement liés.

1. QUESTIONNEUR ET RÉPONDANT

Dans sa version initiale, Robert Bolton avait accordé fort peu d'importance au fait qu'Aristote, au moins à un niveau de sa réflexion sur la méthode dialectique et de sa description de cette méthode, considère l'activité dialectique non seulement comme un dialogue, mais encore comme un dialogue réglé ou même réglementé, dans lequel les rôles du questionneur et du répondant sont nettement différenciés. Il avait, par exemple, expliqué deux passages-clefs, où Aristote annonce (*Top.* I 1, 100a18-21) et récapitule (*Réful. Soph.* 34, 183a37-b6) toute l'entreprise des *Topiques*, sans vouloir y reconnaître la distribution des éléments qui, de façon pourtant hautement significative dans des passages de cette nature, se rapportent respectivement à la tâche du questionneur et à celle du répondant. On ne peut plus reprocher à la nouvelle version de son étude d'avoir négligé cet aspect de la conception

aristotélécienne de la dialectique; ce qu'il faut dire à ce sujet est dit avec clarté et exactitude dans des passages comme ceux que l'on trouve p. 188 (avec la note 6) et pp. 197-198.

Il est cependant visible que Robert Bolton tend à minimiser la portée de cette concession, et ceci de diverses manières au cours des diverses étapes que traverse la description, de plus en plus serrée et approfondie, qu'il donne de la méthode dialectique. Suivons la progression de cette description.

Dès la section 2, que Bolton présente lui-même comme une « première approximation » (p. 187), « intentionnellement sommaire et à divers égards imprécise et incomplète » (p. 190), on voit apparaître le concept de « justification dialectique », concept qui transcende la distinction du questionneur et du répondant, en ce sens que chacun des deux partenaires peut espérer conquérir pour sa thèse (traduisons ainsi l'intraduisible « claim ») une telle « justification dialectique ». Naturellement, Bolton n'ignore pas que cette étiquette unique doit recouvrir des marchandises différentes, selon que l'on considère la thèse du répondant (celle que celui-ci s'engage à soutenir et à défendre contre l'assaut dialectique de son adversaire) ou celle du questionneur (celle, contradictoire ou incompatible avec celle du répondant, que celui-ci entreprend d'établir en obtenant ses prémisses par les questions qu'il pose à son partenaire). Il doit donc définir disjonctivement son concept de « justification dialectique », comme il le fait p. 189 : « Une thèse peut être dite 'dialectiquement justifiée' seulement si, *ou bien* elle suit de façon appropriée d'éléments qui appartiennent à l'ensemble existant des croyances notoires ou accréditées, *ou bien* elle est compatible avec des éléments de cet ensemble de croyances (en ce sens que sa contradictoire ne suit pas de façon appropriée d'éléments de cet ensemble) » (souligné par moi). Des expressions abrégées de la même disjonction se retrouvent, par exemple, p. 190 (« [la dialectique] considère qu'une thèse est dialectiquement justifiée seulement dans le cas où elle est, de façon appropriée, compatible avec certaines croyances répandues, notoires ou accréditées, ou impliquée par ces croyances ») ou p. 192 (« [les définitions dialectiquement adéquates] peuvent être inférées à partir des *endoxa* ou d'un sous-ensemble approprié d'*endoxa*, ou au moins sont compatibles avec eux »).

Cette présentation des choses, sans être inexacte, me semble avoir pour effet de dissimuler ou d'atténuer une différence cruciale entre les deux formes de la « justification dialectique ». La thèse du questionneur sera « justifiée dialectiquement » si et seulement si le questionneur parvient à en faire la conclusion d'un syllogisme dialectique, c'est-à-dire formellement valide et prenant pour prémisses un sous-ensemble de l'ensemble des *endoxa*; cette tâche est en principe faisable dans le cadre d'un entretien dialectique unique et de durée limitée. Dans ce même cadre, le répondant ne peut espérer rien de mieux que mettre en échec

l'entreprise de son partenaire; il aura correctement défendu sa thèse, *p*, si et seulement si l'ensemble limité des prémisses que le questionneur lui a proposées, et qu'il lui a accordées, ne permet pas à celui-ci de parvenir valablement à la conclusion *non-p*. Dans de telles conditions, il paraît difficile de dire que *p*, la thèse du répondant, se trouve « justifiée dialectiquement »; tout ce que l'on peut dire est qu'elle n'est pas, ou qu'elle n'a pas été, dialectiquement disqualifiée ou in-justifiée. Pour passer de ce statut de non-injustification (ou, si l'on veut, de non-infirmité) dialectique à un statut de justification ou de confirmation dialectique, analogue à celui que la thèse du questionneur est susceptible d'acquérir d'un seul coup, il faudrait que la thèse du répondant soit soumise à une multiplicité d'épreuves dialectiques dont elle sortirait chaque fois indemne, chacune de ces épreuves se différenciant, non pas nécessairement par la personnalité du questionneur, mais plutôt par la sélection des *endoxa* utilisés dans la tentative de réfutation de la thèse du répondant. Même en supposant que le nombre des *endoxa* pertinents pour la discussion de cette thèse ne soit pas indéfini, il est clair qu'une entreprise de ce genre déborderait les limites de l'entretien dialectique, tel que les *Topiques* en définissent les règles du jeu. Une notion claire et univoque de « justification dialectique », notion vraisemblablement utile et même nécessaire pour l'étude de l'intervention de la méthode dialectique dans les traités de science et de philosophie, ne semble donc pas pouvoir être aisément extraite de la description que donnent les *Topiques* de l'activité dialectique, en raison du rôle essentiel que joue dans cette description, à mon sens, l'articulation des rôles de questionneur et de répondant, et l'asymétrie des conditions faites aux thèses respectives de l'un et de l'autre.

C'est pourquoi deux attitudes sont théoriquement possibles, me semble-t-il, par rapport aux *Topiques* : *ou bien* l'on considère que ce traité contient les éléments pertinents qui permettent de répondre aux questions que pose l'emploi des procédures de justification dialectique dans les traités de science et de philosophie, et dans ce cas l'on est conduit à minimiser ou à neutraliser l'essentialité du rapport dialogique questionneur/répondant dans la méthode dont traitent les *Topiques*; c'est ce que fait dans l'ensemble Robert Bolton, qui remarque avec bon sens qu'après tout, lorsque Aristote procède « dialectiquement » dans ses traités, il fait lui-même les demandes et les réponses (p. 199); *ou bien* l'on considère (comme j'ai plutôt tendance à le faire) que les *Topiques* sont écrits, pour l'essentiel, dans la perspective d'un dialogue scolairement codifié entre questionneur et répondant, et l'on est alors conduit à penser qu'ils ne livrent pas immédiatement (même en tenant compte des quelques indications qu'ils contiennent sur les fonctions philosophiques de la méthode) les éléments nécessaires à la compréhension du statut épistémologique de la méthode dialectique dans les traités de science et

de philosophie. Il semble, en d'autres termes, qu'un hiatus subsiste entre la méthode décrite dans les *Topiques* et la dialectique mise en œuvre dans les traités : dès lors, ou bien l'on tente de combler ce hiatus en considérant comme relativement accessoires les aspects strictement dialogiques de la méthode des *Topiques*, ou bien on le laisse subsister en prenant ces aspects au sérieux, quitte à admettre que la dialectique philosophique des traités ne se superpose pas exactement à celle des *Topiques*.

Suivons maintenant le fil de cette question. Dans la section 4 de son étude, Bolton revient avec plus de détail, comme il l'avait annoncé, sur la description intentionnellement sommaire qu'il avait d'abord donnée de la méthode des *Topiques* (il s'agit maintenant, est-il dit p. 196, «de considérer plus soigneusement ce qu'Aristote lui-même dit au juste sur la façon de faire de la dialectique»). L'un des premiers effets de cette attention plus soignée est d'ailleurs de remarquer que, de l'aveu exprès d'Aristote, l'exposé des *Topiques* a lui-même le caractère d'une «esquisse» sommaire (I 1, 101a19-24; la déclaration ne vaut pas seulement pour «tout ce qui vient d'être dit», mais aussi pour «tout ce qui sera dit par la suite»); nous verrons plus tard comment Bolton exploite cet avertissement d'Aristote.

En attendant, notons que la traduction et le nouveau commentaire qui sont donnés, pp. 196-197, de la phrase initiale des *Topiques* (101a18-21), continuent à respecter impeccablement la distinction des rôles du questionneur et du répondant. La discussion peut cependant rebondir à propos de ce qui est dit, p. 197, du «conflit potentiel» qui menace les deux contraintes qui s'exercent sur le répondant : (1) se soumettre à une argumentation qui procède à partir des *endoxa* et (2) éviter de tomber ou de se laisser enfermer dans une contradiction. Selon Bolton, ces deux réquisits sont en conflit potentiel, parce qu'il est possible que les *endoxa* concernant le sujet en discussion soient incompatibles entre eux. Cette possibilité, sur laquelle il faudra revenir en détail, risque de rendre le combat totalement inégal entre le questionneur et le répondant. «Si le répondant, écrit Bolton p. 197, est contraint de soumettre sa thèse à *n'importe quel* raisonnement valide fondé sur *n'importe quels endoxa*, alors son obligation d'éviter la contradiction devient difficile au point d'être impossible» (parce qu'au moins en droit, le questionneur pourra toujours trouver, dans l'ensemble des *endoxa* incompatibles entre eux, ceux qui lui permettront de réfuter la thèse du répondant, quelle qu'elle soit). Concernant le questionneur, la contrepartie se déduit par symétrie : «à ce compte, la tâche du questionneur devient trivialement facile». Autrement dit : sous la supposition que les *endoxa* concernant un sujet donné peuvent être en conflit (supposition capitale, et à vérifier), on ne peut plus donner de contenu raisonnable à la distinction des rôles de questionneur et de répondant, et celle-ci s'effondre.

On ne peut comprendre, selon Bolton, la valeur justificative du raisonnement dialectique qu'au prix de ce collapsus du couple questionneur/répondant. En effet, si l'on cherche à résoudre les cas (supposés) de conflit entre *endoxa* en permettant à chaque partenaire de s'appuyer sur tel sous-ensemble non-contradictoire d'*endoxa* qui convient à ses objectifs propres, le caractère arbitraire du choix de ce sous-ensemble réduira à fort peu de chose le pouvoir justificatif du raisonnement dialectique, par rapport aux conclusions qu'il est supposé établir ou réfuter. Même si l'on imposait aux deux partenaires de s'entendre pour s'appuyer tous deux sur le sous-ensemble non-contradictoire *maximal* d'*endoxa* pertinents, la mise hors jeu des *endoxa* incompatibles avec ceux qui ont été retenus diminuerait encore très fortement la respectabilité épistémologique des résultats que l'on peut attendre de la méthode; dans cette hypothèse, en effet, celle-ci ferait abstraction de certaines données pertinentes, pour la seule raison qu'elles ne s'accordent pas avec la majorité des autres.

Ces difficultés relancent la réflexion de Bolton sur la «justification dialectique» dans une nouvelle direction. Dans un premier temps, on observe qu'il neutralise incidemment la distinction du questionneur et du répondant («ces questions ... sont d'une importance toute spéciale pour déterminer quelle espèce de justification épistémologique peut être procurée à une thèse donnée (*pour le questionneur, ou pour le répondant, ou pour les deux*) par un échantillon satisfaisant de raisonnement dialectique», p. 198 — souligné par moi); un peu plus loin, cette même distinction se trouve mise entre parenthèses, de façon méthodique et explicite. Non sans quelque paradoxe, après avoir annoncé qu'il examinerait de façon détaillée «ce qu'Aristote lui-même dit sur la façon de faire de la dialectique» (p. 196), Bolton estime utile, pour résoudre les questions qu'il vient de soulever, et qu'il se plaint de voir «fondamentalement ignorées dans la littérature du sujet», de «simplifier quelque peu [sa] description de la dialectique» (p. 198). Cette simplification consiste à ne plus tenir compte de l'aspect dialogique de la dialectique aristotélicienne, aspect qui n'est plus qu'un «reflet de l'histoire de la question» (p. 198); et cette abstraction est tenue pour légitime, surtout si l'on se souvient, comme ce serait ici l'occasion toute particulière de le faire, qu'Aristote présente lui-même le contenu des *Topiques* comme une «esquisse» qui ne vise pas à l'«exactitude».

Remarquons au passage qu'au prix d'une certaine incohérence, Bolton pense trouver dans les *Topiques* eux-mêmes les matériaux nécessaires pour corriger leur manque d'«exactitude». Ainsi, ils montreraient que la structure duelle de l'entretien dialogique n'est pas essentielle à la méthode dialectique, puisque Aristote y recommande à l'apprenti dialecticien comme au dialecticien philosophe de s'y exercer tout seul (cf. les textes cités p. 198). Je ne crois pourtant pas que ces

recommandations puissent servir d'argument à la thèse de Bolton, car les exercices solitaires qu'Aristote y prescrit sont manifestement des exercices préparatoires, et rien dans le texte ne dit que celui qui s'y livre fasse déjà de la dialectique; on peut parfaitement penser qu'il ne fait que se préparer à en faire, et qu'il n'en fera que lorsqu'il sera en situation dialogique.

Quoi qu'il en soit, nous ne sommes pas au terme de l'élaboration progressive de la notion de « justification dialectique » que nous propose Robert Bolton. Dans une dernière étape de son développement, il soutient que l'on pourrait en atteindre la compréhension en considérant « la valeur épistémologique des résultats atteints par une voie qui se conformerait aux réquisits *conjoin*ts qui doivent être respectés dans une discussion dialectique à deux personnes, à la fois par le questionneur et par le répondant, qu'il y ait ou non deux personnes réelles qui soient responsables de ces résultats » (p. 198 — souligné par moi).

On remarquera qu'au terme de ce développement, la notion de « justification dialectique » s'est sensiblement transformée : alors qu'elle était, au départ de la réflexion de Bolton, définie *disjonctivement* (est dialectiquement justifiée une thèse qui satisfait *soit* aux règles imposées au questionneur, *soit* à celles imposées au répondant), elle est maintenant définie *conjonctivement* (est dialectiquement justifiée une thèse qui satisfait à la fois aux règles imposées à l'un et à l'autre). Mais il ne s'agit ici, j'en ai bien peur, que d'un hommage rendu du bout des lèvres au couple dialectique du questionneur et du répondant : car cette définition conjonctive permet de considérer comme indifférente la question de savoir si les deux rôles s'incarnent ou non en deux interlocuteurs réels; en outre, s'il était vrai, comme Bolton a cherché à le montrer une page auparavant, que les tâches du répondant et du questionneur (sous la condition, supposée remplie, de la possibilité d'un conflit entre *endoxa*) sont l'une impossible et l'autre triviale, on n'obtiendrait rien de plus substantiel en conjoignant les réquisits qu'elles doivent remplir.

N'oublions pas, toutefois, que l'ensemble de ce développement reste subordonné à l'hypothèse d'une possibilité de conflit entre *endoxa*. Sous ce rapport, on pourrait résumer comme suit le raisonnement de Robert Bolton : (a) les *endoxa* peuvent être en conflit, et ils le sont habituellement sur les questions les plus difficiles et les plus importantes; (b) quand ils le sont, le rôle du répondant devient difficile jusqu'à être impossible, et celui du questionneur facile jusqu'à être trivial; (c) si l'on veut comprendre que la méthode dialectique décrite dans les *Topiques* puisse avoir une valeur justificative, à l'égard des énoncés qui, dans les traités scientifiques, se présentent comme la solution des problèmes sur lesquels il y a des conflits entre les *endoxa*, il faut donc débarrasser cette méthode du vêtement dialogique qui n'est que le vestige superficiel de son histoire antérieure.

Il convient donc d'examiner maintenant la prémisse fondamentale de cette ligne d'argumentation.

2. LA QUESTION DU CONFLIT ENTRE *ENDOXA*

Qu'Aristote envisage la possibilité de conflits entre *endoxa*, c'est ce qui risque de sembler évident au lecteur d'ouvrages comme la *Physique*, la *Métaphysique* ou les *Éthiques*. Les recherches que contiennent ces traités sont régulièrement introduites, on le sait, par des revues doxographiques où se trouvent confrontées diverses opinions, opinions communes et opinions d'experts, sur le sujet à l'ordre du jour. Le conflit de ces opinions joue un rôle essentiel dans l'exploration complète des apories que comporte le sujet, et dans la résolution de ces apories. Il semble, par ailleurs, que toutes ces opinions puissent être considérées comme des *endoxa*, par application directe de la définition même de ce terme dans les *Topiques*. Dès lors, on devrait pouvoir considérer qu'il y a bien des conflits entre *endoxa*, et que ces conflits ont pour lieux privilégiés les questions les plus importantes et les plus difficiles que le philosophe puisse se donner la tâche de résoudre.

Mais Aristote admet-il, dans les *Topiques*, que les *endoxa* (j'entends, naturellement, les *endoxa véritables*, pour réserver le cas des *endoxa apparents*, sur lesquels prennent appui certains des raisonnements éristiques, 100b23 ss) puissent être en conflit? Cela reste à voir. Bolton donne assez rapidement une réponse affirmative à cette importante question, en disant (p. 197) que les *endoxa* comprennent à la fois les vues de la majorité et celles des experts (cf. en effet la définition disjonctive de 100b21-23), et qu'Aristote sait bien que sur les problèmes qui méritent une discussion, les vues de ces deux groupes tendent à être en conflit, aussi bien d'un groupe à l'autre qu'à l'intérieur de chacun des deux groupes. Pour documenter cette dernière affirmation, Bolton renvoie au chapitre I 11 des *Topiques*. Ce chapitre, qui est consacré aux problèmes dialectiques, décrit effectivement ces derniers comme des questions sur lesquelles il y a, soit absence d'opinions en un sens ou en l'autre (*oudeterôs doxazousin*, 104b4), soit conflit d'opinions (*enanliôs*, sc. *doxazousin*) entre la majorité et les experts, soit encore conflit d'opinions à l'intérieur de chacun de ces groupes. Il est donc incontestable, et d'ailleurs évident, qu'il existe des conflits d'opinions. Mais la question reste de savoir si ces conflits *entre opinions* (*doxazousin*) sont des conflits *entre endoxa*. Ou, pour poser la même question en d'autres termes : une opinion qui est en conflit (réel et non pas seulement possible, bien entendu) avec une autre opinion, à quelque groupe d'hommes qu'elle appartienne, peut-elle être encore comptée comme un *endoxon*, ou bien est-elle inapte à être comptée comme telle, du seul fait de cette relation de conflit?

Une première raison de penser qu'il ne peut y avoir de conflit entre *endoxa* est que les conflits entre opinions que Bolton considère comme des conflits entre *endoxa* sont évoqués par Aristote à propos de la notion de *problème* dialectique, alors que la notion d'*endoxon* sert essentiellement à caractériser les *prémisses* du syllogisme dialectique. La distinction entre prémisses et problèmes est un élément fondamental dans l'articulation conceptuelle du livre I des *Topiques*; elle s'y présente de façon récurrente, soit sous forme directe (*prolasis* vs. *probléma*), soit sous forme paraphrastique (*ex hōn hoi logoi* vs. *peri hōn hoi sullogismoi*, 101b13-16, cf. 103b39). Cette distinction, à laquelle Bolton ne fait aucune référence, doit servir de fil conducteur pour résoudre la question qui nous occupe, celle de l'éventuel conflit des *endoxa*.

Pour qu'un problème, c'est-à-dire une question de forme «est-ce que *p* ou non-*p*?» (I 4, 101b32-34), puisse constituer un problème *dialectique*, c'est-à-dire un problème qui «mérite d'être discuté» (I 11, 105a4), il faut qu'il «contienne une difficulté» (*echein aporian*, 104a7, 105a9). Le conflit des opinions relatives à cette question, sous quelque forme qu'il se présente (entre la majorité et les experts, entre experts, etc.), peut servir d'indice ou de critère de la présence d'une telle difficulté. Mais le caractère «problématique» même du «problème» empêche chacune des deux réponses qui peuvent lui être données (*p* ou non-*p*) de pouvoir jouer le rôle de prémisses dans un syllogisme dialectique, c'est-à-dire de compter comme un *endoxon*. En effet, si la prémisses dialectique doit être un *endoxon* (104a8-10), c'est pour qu'il soit aussi difficile que possible au répondant de la refuser au questionneur. Dans l'hypothèse où un *endoxon* A pourrait être en conflit avec un autre *endoxon* B, le répondant n'aurait que trop de facilité à refuser A, que lui propose le questionneur, en prenant lui-même appui sur B. C'est une première raison de penser que l'hypothèse d'un conflit entre *endoxa* n'est pas envisagée par Aristote, dans la description de la méthode dialectique qu'il présente dans les *Topiques*.

Examinons cependant quelques arguments que l'on pourrait essayer d'avancer dans le sens inverse. Si Bolton a pensé pouvoir utiliser la description du problème dialectique que contient le chapitre I 11 à l'appui de sa supposition qu'un conflit entre *endoxa* était toujours possible, c'est peut-être parce que, dans le chapitre I 4 (101b28-36), Aristote présente la différence entre *prolasis* et *probléma* comme une différence de pure forme. Aussi longtemps qu'elle est une question à laquelle on est plus ou moins forcé de répondre par l'affirmative, en raison du caractère *endoxon* de cette réponse, une *prolasis* est en effet une interrogation simple, de forme «est-ce que *p*?». Un *probléma*, de son côté, est une interrogation double, de forme «est-ce que *p* ou non?». A ce premier niveau de son analyse, Aristote peut donc prendre des exemples qui ont le même contenu matériel pour illustrer la *prolasis* («est-ce que

'vivant terrestre bipède' est la définition de l'homme?») et pour illustrer le *probléma* («est-ce que 'vivant terrestre bipède' est la définition de l'homme, ou non?»); il précise même qu'«à partir de toute *prolasis* on peut faire un *probléma* en changeant [simplement] la forme» (*melaballōn lōi tropōi*, 101b36). Il pourrait donc sembler légitime de déduire de là que des *endoxa* peuvent être en conflit. En effet, si un problème dialectique est une *question* sur laquelle les experts (par exemple) sont en désaccord, parce qu'ils lui donnent des réponses contradictoires, chacune de ces réponses est un *énoncé* sur lequel ils sont en désaccord, parce que les uns l'approuvent et que les autres le rejettent. Mais, s'il est vrai qu'il suffit d'un changement de forme pour transformer une prémisses en problème et un problème en prémisses, chacune des réponses contradictoires apportées par les experts à une question problématique paraît pouvoir jouer le rôle de prémisses. Comme elles sont en conflit, il doit y avoir des conflits entre prémisses. Et comme les prémisses dialectiques sont des *endoxa*, il doit y avoir des conflits entre *endoxa*.

En réalité, ce raisonnement est un *non sequitur*. Il repose sur l'oubli de la distinction entre prémisses et problèmes d'une part, prémisses dialectiques et problèmes dialectiques d'autre part. Ce que dit Aristote au chapitre I 4, concernant la différence purement formelle entre prémisses et problèmes, ne vaut que pour les prémisses et les problèmes *en général*. Mais «il ne faut pas poser que toute prémisses est dialectique, ni que tout problème est dialectique» (I 10, 104a4-5). Outre les différences formelles qui séparent la prémisses dialectique en tant que prémisses et le problème dialectique en tant que problème, il faut compter avec les différences épistémologiques qui les séparent en tant que prémisses dialectiques et que problèmes dialectiques : le problème dialectique soulève une aporie, il engendre ou peut engendrer des conflits d'opinions; la prémisses dialectique est un *endoxon*. Si l'on considère un problème dialectique, comme «le monde est-il éternel ou non?» (104b8), il ne peut être question d'attribuer le statut d'*endoxa* aux énoncés contradictoires («le monde est éternel», «le monde n'est pas éternel») dont la contradiction même le qualifie comme problème; c'est au contraire le fait que chacun a ses partisans autorisés qui le qualifie comme problème dialectique.

Mais, dira-t-on peut-être, la possibilité d'un conflit entre *endoxa* n'est-elle pas inscrite dans la définition même de ces *endoxa*? Cette définition, on s'en souvient, est en effet disjonctive : sont *endoxa* «les choses qui sont acceptées (a) par tous, ou (b) par la plupart des gens, ou par les *sophoi*, et pour ceux-ci soit (c) par tous, soit (d) par la plupart, soit (e) par les plus célèbres et les plus distingués» (100b21-23, traduction inspirée de celle de Bolton, p. 189). Dans la section 8 de son étude (pp. 208-212), Robert Bolton soutient, avec beaucoup de plausibilité, que l'ordre dans lequel Aristote énumère les divers types d'*endoxa* n'est

pas accidentel : la liste va, en ordre décroissant, des types dotés (au moins en première analyse) de l'autorité maximale aux types dotés (toujours en première analyse) de l'autorité minimale. Que l'ordre de la liste ne soit pas dû au hasard, c'est certainement tout à fait exact. Mais il serait inexact de croire que la question de savoir si les *endoxa* d'un niveau supérieur d'autorité peuvent entrer en conflit avec des *endoxa* d'un niveau inférieur d'autorité s'en trouve réglée pour autant. En effet, deux interprétations différentes de cette hiérarchie peuvent être envisagées (je laisse de côté la question de savoir s'il peut y avoir des conflits entre *endoxa* de même niveau, par exemple entre opinions également admises par tous : il me semble qu'aucun texte ne permet de penser qu'Aristote admettrait une telle possibilité).

Dans la première interprétation de la hiérarchie des types d'*endoxa*, il peut y avoir des conflits entre *endoxa* de niveaux différents, parce que ce qu'on peut appeler le caractère endoxal, ou l'endoxalité, d'une opinion lui appartient absolument, si et seulement si elle appartient à l'un des types d'*endoxa* distingués par Aristote, et quels que soient par ailleurs le nombre et la qualité des gens qui ne la partagent pas. Supposons que, sur une question donnée, la plupart des hommes croient que *p*, et que la plupart des experts croient que *non-p* : *p* sera un *endoxon* parce qu'il appartient au type (b) de la définition, et *non-p* sera aussi un *endoxon* parce qu'il appartient au type (d) de la définition. Ainsi peut-on obtenir sans aucune difficulté, dans cette interprétation de la définition, deux *endoxa* contradictoires.

Toutefois, les déclarations ultérieures d'Aristote ne semblent pas aller dans ce sens : lorsqu'il reprend la liste des types d'*endoxa* pour définir la prémisses dialectique (104a8-11), il prend soin de préciser que les opinions des experts ne comptent comme des *endoxa* que si elles ne sont pas des *paradoxa*, c'est-à-dire si elles ne sont pas en conflit avec les *endoxa* de niveau supérieur, ceux qui sont acceptés par tous les hommes ou par presque tous ; en effet, dit Aristote, on pourrait parfaitement poser (comme prémisses dialectiques) l'opinion des experts, « si [du moins] elle n'est pas contraire aux opinions de la majorité des hommes » (104a11-12). L'endoxalité d'une opinion experte *p* dépend donc, non seulement de ce que pensent les experts, mais aussi de ce que pense simultanément la majorité sur la même question : si la majorité pense que *p*, *p* est certes un *endoxon*, mais pour une raison qui n'est plus la caution des experts, et qui est précisément la caution de la majorité ; si la majorité pense que *non-p*, c'est *non-p* qui est un *endoxon*, et *p* n'en est pas un, malgré la caution des experts ; si la majorité n'incline ni du côté *p* ni du côté *non-p*, *p* est alors un *endoxon*, pour la raison précise que les experts lui donnent leur caution.

Je n'ai pas de désaccord sur ce point avec Robert Bolton, qui dit tout ce que je viens de dire très clairement et très exactement : je me

borne à renvoyer au commentaire qu'il donne, p. 210, de la définition aristotélécienne de la prémisses dialectique (104a8-13). Cependant, il croit bon d'ajouter : « Naturellement, l'opinion d'un expert continue à compter, *par définition*, comme un *endoxon* (100b21-23), même si elle est contraire à l'opinion de la majorité » (p. 210, souligné par moi). Là, je cesse d'être d'accord : car ce n'est nullement la définition aristotélécienne de l'*endoxon* qui implique cette conception, laquelle à son tour implique la possibilité du conflit des *endoxa* : c'est seulement l'interprétation particulière que donne Bolton de cette définition.

En effet, la disjonctivité de la définition initiale de l'*endoxon* est ambiguë. On peut la comprendre d'abord comme suit : est *endoxon* ce qui répond à la description (a), et aussi bien ce qui répond à la description (b), etc. Dans ce cas, l'adjonction de *mè paradoxos*, en 104a10-11, est une véritable adjonction, qui modifie le sens de la définition ; mais alors les deux textes deviennent virtuellement contradictoires, une opinion paradoxale d'expert devant compter, selon 104a10-11, comme *n'étant pas un endoxon*, et selon 100b21-23, comme *étant un endoxon*. Cette difficulté disparaît si l'on considère que la disjonctivité de la définition initiale doit s'interpréter, par anticipation, à la lumière de l'adjonction *mè paradoxos*, c'est-à-dire si on la comprend ainsi : est *endoxon* ce qui répond à la description (a), ou bien, s'il n'existe sur le sujet considéré aucune opinion répondant à la description (a), ce qui répond à la description (b), etc. Dans cette seconde interprétation de la hiérarchie des types d'*endoxa*, l'adjonction *mè paradoxos* de 104a10-11 ne modifie pas le contenu de la définition initiale ; une opinion d'expert ne comptera comme un *endoxon* que s'il n'existe pas, sur le sujet considéré, d'opinion déterminée admise par tous les hommes, ou par presque tous. L'*endoxon* en question ne sera donc en conflit, par définition (en vertu de la définition ainsi comprise), avec aucun autre *endoxon*. Et de même dans les autres cas de figure.

Les difficultés dans lesquelles se trouve engagé Bolton pour avoir adopté la première interprétation se constatent immédiatement. Comment, se demande-t-il p. 210, un *endoxon* constitué par l'opinion paradoxale d'un expert peut-elle s'introduire avec quelque poids dans la discussion dialectique ? « Le répondant ne sera-t-il pas toujours en droit de la rejeter d'emblée, puisqu'elle est en conflit avec l'opinion, plus *endoxon*, de la majorité ? » D'après lui, cependant, Aristote montrerait dans les *Topiques* comment les vues des experts, même lorsqu'elles sont en conflit avec celles de la majorité, peuvent être « introduites et même défendues avec succès dans la dialectique ». La preuve en serait la théorie de la *thesis*, dont l'exposé se trouve au chapitre I 11, 104b19-28 (l'essentiel de ce passage est cité par Bolton, p. 210). Ce passage indiquerait, selon lui, comment une vue qui est, par elle-même, contraire à l'opinion générale peut acquérir un « standing » approprié dans la

discussion dialectique. L'ennui est que ce mot vague de «standing» occulte la différenciation, ici plus nécessaire que jamais, entre prémisses et problème. Une opinion paradoxale, si elle répond à certaines conditions déterminées (être soutenue par un philosophe célèbre, ou bien pouvoir s'appuyer sur une argumentation raisonnable), acquiert effectivement un «standing» dialectique, mais à titre de *problème dialectique*, c'est-à-dire à titre de question qu'il est légitime de prendre pour sujet d'une discussion dialectique : Aristote précise expressément que les *theseis* sont une sous-espèce des «problèmes» (dialectiques) (104b29-34), en dépit de l'usage laxiste «actuel» qui donne le nom de *theseis* à tous les «problèmes dialectiques» (104b34 ss). Il n'est pas non plus impossible, dans ces conditions, qu'une *thesis* obtienne une autre forme de «standing» dialectique, à savoir celle d'une thèse défendue avec succès : il se peut en effet qu'à l'issue de l'entretien dialectique, la *thesis* paradoxale de l'expert ait résisté à un effort de réfutation : cette *thesis* acquiert alors le statut de conclusion dialectiquement non disqualifiée, comme nous l'avons vu ci-dessus. En revanche, non seulement le «standing» dialectique des *theseis* ne signifie nullement qu'elles puissent être des *endoxa*, mais encore la définition de leurs diverses espèces (104b19-28, 31-34) implique qu'aucune ne peut être un *endoxon*. Il s'ensuit, si je ne me trompe, d'une part, qu'aucune *thesis* ne peut servir de prémisses dialectique, puisque toute prémisses dialectique doit être un *endoxon* ; d'autre part, que le conflit entre une *thesis* et les opinions qui la contredisent n'est pas un conflit entre *endoxa*.

Reste encore un argument à considérer, celui qui prendrait appui sur l'introduction des *degrés d'endoxalité*. C'est, d'une façon générale, un des grands mérites de l'étude de Robert Bolton que d'avoir attiré l'attention sur une différence importante, et souvent négligée, entre la description initiale de la méthode dialectique, au début des *Topiques* (100a18-21), et la description récapitulative de cette même méthode vers la fin des *Réfutations sophistiques* (34, 183a37 ss, cité par Bolton p. 199). Il relève à très juste titre que la nouvelle description introduit, en tout cas formellement, une nouveauté importante : le raisonnement dialectique, ou peut-être un certain type de raisonnement dialectique, est ici décrit comme un raisonnement qui procède, non pas simplement à partir d'*endoxa*, mais plus précisément *ek tôn huparchontôn hōs endoxotatōn* (183a38), c'est-à-dire à partir de ce qui est le plus *endoxon*, ou de ce qui est aussi *endoxon* que possible.

Laissons de côté, pour le moment, la question de savoir si cette formulation nouvelle constitue une innovation substantielle dans la description de la méthode dialectique, et si cette innovation signifie que l'objet de cette description n'est plus la dialectique en général, mais une forme particulière de la dialectique, celle qu'Aristote désigne ici sous le nom de *peirastique*. Cette question fera l'objet de notre section suivante.

Demandons-nous seulement, dans le cadre de la question qui nous occupe maintenant, si l'acceptation de degrés d'endoxalité implique ou non la possibilité de conflits entre *endoxa*. Si un énoncé *p* est plus *endoxon* qu'un autre énoncé *q*, cela implique évidemment que *p* et *q* sont tous deux *endoxa*, quoique à des degrés divers. Mais cette situation peut-elle se réaliser lorsque *p* et *q* sont contradictoires ou incompatibles ?

Pour Bolton, la réponse affirmative ne fait pas de doute. Il écrit par exemple (p. 199) : «[la nouvelle formulation donnée dans les *Réfutations*] suggère ... que si les prémisses d'un argument sont *endoxa*, et si même elles sont tirées du sous-ensemble consistant maximal des *endoxa*, mais si elles sont en conflit avec d'autres *endoxa* qui sont plus *endoxa* qu'elles-mêmes ne le sont, alors l'argument qui prend appui sur elles ne sera pas un argument proprement dialectique, ou du moins il ne sera pas le meilleur argument dialectique (possible), puisqu'il ne prend pas appui sur ce qui est le plus *endoxon* parmi les *endoxa* pertinents sur le sujet considéré». On voit clairement dans ce passage que, selon Bolton, pour qu'un argument A soit dialectiquement disqualifié au profit d'un argument B, il faut que les prémisses P^A de A soient en conflit avec des prémisses plus *endoxa* P^B , qui sont les prémisses de B. Deux conditions sont donc ici conjointes : (1) les P^A sont plus *endoxa* que les P^B ; (2) les P^A sont en conflit avec les P^B .

À mon avis, cependant, ces deux conditions, loin de pouvoir se conjindre, s'excluent mutuellement. Si la seconde est réalisée, nous l'avons déjà vu, ou bien les P^A ne sont pas *endoxa*, ou bien les P^B ne le sont pas, ou bien enfin ni les unes ni les autres ne le sont ; de sorte qu'il n'y a pas entre elles inégalité d'endoxalité. Il me reste, bien sûr, la charge de montrer comment la première condition peut et doit être réalisée sans que la seconde le soit.

On peut le faire brièvement, me semble-t-il, de la façon suivante, en adoptant un schéma simplifié autant qu'il est nécessaire. Entre le sujet et le prédicat de la conclusion à prouver, le raisonnement consiste à intercaler un moyen terme. Supposons qu'une même conclusion puisse être atteinte, dans l'argument A, par l'intercalation d'un moyen terme «savant» M^A , et, dans l'argument B, par l'intercalation d'un moyen terme «non-savant» M^B . Les prémisses «savantes» P^A sont des *endoxa* s'il n'y a pas d'opinion commune ou générale, en un sens ou en l'autre, sur les rapports entre M^A et les termes de la conclusion. Les prémisses «non-savantes» P^B sont des *endoxa* si les rapports appropriés entre M^B et les termes de la conclusion sont endossés par l'opinion commune ou générale. Dans ces conditions, (1) il n'y a pas et il ne peut y avoir de conflit entre les P^A et les P^B , la différence entre les moyens termes M^A et M^B rendant inaptes à se contredire les prémisses où figurent ces moyens termes ; (2) les P^A et les P^B sont, les uns et les autres, des *endoxa* ; (3) les P^B sont plus *endoxa* que les P^A , parce que leur endoxalité se situe à un

niveau supérieur sur l'échelle des degrés d'endoxalité; par suite, l'argument B est dialectiquement préférable à l'argument A.

On peut conclure de cette analyse, me semble-t-il, que l'hypothèse d'une possibilité de conflits entre *endoxa* ne trouve pas d'appui dans la notion des degrés d'endoxalité.

Cette notion soulève un autre problème, auquel j'ai fait allusion ci-dessus. Lorsqu'Aristote introduit, dans la description de la méthode dialectique du chapitre final des *Réfutations*, l'expression *ex endoxotatôn*, formellement différente de l'expression *ex endoxôn*, qu'il avait employée dans la description initiale des *Topiques*, entend-il faire comprendre que ce qu'il décrit maintenant n'est plus qu'une espèce particulière de ce qu'il décrivait initialement? Telle est la question que je voudrais discuter à présent.

3. DU DÉBUT DES *TOPIQUES* À LA FIN DES *RÉFUTATIONS*

Revenons donc au texte récapitulatif des *Réfutations sophistiques* (34, 183a37 ss, cité par Bolton p. 199), pour l'étudier à un autre point de vue que dans la section précédente. L'une des différences qui séparent ce texte de la présentation initiale de la méthode dans les *Topiques* (I 1, 100a18-21) est, nous l'avons vu, qu'Aristote s'écarte (ou paraît s'écarter) de sa première description du raisonnement dialectique. Dans celle-ci, le raisonnement dialectique était décrit comme un raisonnement qui procède «à partir d'*endoxa*». Dans la nouvelle description, Aristote introduit (ou paraît introduire) une nouvelle exigence, en demandant à la fois au questionneur et au répondant de se contraindre à ne plus raisonner qu'«à partir de ce qui est le plus *endoxon*, ou de ce qui est aussi *endoxon* que possible» (183a8, b6). Quelle est la signification de cet écart?

Notons au passage qu'il ne peut être mis sur le compte d'une hypothétique évolution de la pensée d'Aristote entre les *Topiques* (au sens étroit du terme) et les *Réfutations*, même s'il peut y avoir d'autres traces d'une telle évolution: car, comme le signale très honnêtement Bolton lui-même, p. 200, l'expression *ek tôn endoxôn* continue à servir à la caractérisation des arguments dialectiques dans les *Réfutations*, au chapitre 2 (165b3-4).

Cependant, pour Robert Bolton, cet écart entre les deux textes, et la réalité substantielle de l'innovation qu'il représente dans le second par rapport au premier, ont une signification fondamentale et servent d'appui essentiel pour son interprétation. Il leur associe étroitement une autre différence qui sépare les deux textes, et qui concerne la désignation même de la méthode décrite dans chacun d'eux: dans les textes du livre I des *Topiques*, celle-ci s'appelle simplement «la dialectique» ou «le raisonnement dialectique»; dans le texte récapitulatif, en 183a39, la

tâche à laquelle il s'est agi de fournir ses moyens est décrite comme celle de «la dialectique *kath'hautên* et de la peirastique». Bolton traduit cette expression de la façon suivante: «la dialectique au sens strict et la peirastique» (p. 199 et p. 200); je reviendrai plus loin sur cette traduction. En couplant les deux innovations qui caractérisent le second passage, par rapport au premier, on obtient ainsi l'hypothèse suivante: la règle qui impose seulement de raisonner à partir de ce qui n'est qu'*endoxon* caractériserait de façon minimale la dialectique en tant que telle, sous toutes ses formes y compris les moins exigeantes, tandis que la règle qui impose de raisonner à partir de ce qui est le plus *endoxon* «ne serait pas exigible dans certaines des formes ou usages de la dialectique, et le serait seulement dans d'autres, en particulier dans la forme particulière de la dialectique qui s'appelle la peirastique» (p. 200).

Avant d'apprécier cet élément capital de l'interprétation de Robert Bolton, je présenterai d'abord une observation générale, qui peut avoir quelque intérêt sur le plan de la méthode. Ici comme dans un cas précédemment étudié, nous nous trouvons en présence de ce qu'on pourrait appeler des réitérations à variantes dans le texte d'Aristote. Tout à l'heure, deux passages distincts (I 1, 100b21-23 et I 10, 104a8-11), l'un précédant l'autre de quelques pages, décrivaient les divers types d'*endoxa*; le second contenait une précision absente du premier (à savoir, que les opinions d'experts sont *endoxa* à condition de ne pas être en contradiction avec les opinions de la majorité). Dans le cas qui nous occupe maintenant, on observe une relation analogue entre deux textes, cette fois beaucoup plus éloignés l'un de l'autre. Le second introduit une détermination différente, et formellement plus stricte, du caractère des prémisses dialectiques (*ex endoxotatôn* vs. *ex endoxôn*); en outre, il semble fournir les moyens de rendre compte de cette différence en laissant supposer, moyennant l'interprétation appropriée d'une expression difficile, que l'objet décrit n'est pas exactement le même dans les deux descriptions (la dialectique en général vs. une ou plusieurs formes particulières de la dialectique).

Le problème d'exégèse se pose en termes voisins dans les deux cas: lorsque, par rapport à une description antérieure A, une description postérieure B introduit des éléments formellement nouveaux, faut-il en conclure que l'objet décrit par B n'est pas, ou a de bonnes chances de n'être pas, le même objet que l'objet décrit par A, ou bien doit-on penser que l'objet des deux descriptions reste le même, les éléments formellement nouveaux apportés par la description B devant être lus, en quelque sorte par anticipation, comme sous-entendus dans la description A? Nous avons vu plus haut (pp. 248-9) que dans le cas de la description des divers types d'*endoxa*, la seconde solution paraissait devoir être préférée à la première, *pace* Bolton. Il pourrait se faire qu'il en soit de même dans le cas présent, c'est-à-dire que le réquisit d'endoxalité *maximale*,

formellement exprimé dans le second texte seulement, ne soit qu'une façon de réécrire plus précisément, après tout le chemin parcouru entre temps, le réquisit d'endoxalité tout court, tel qu'il figurait dans le premier texte. La plus grande simplicité de l'expression, dans ce premier texte, s'expliquerait facilement : à son niveau, qui est celui de la toute première phrase du traité, la notion d'*endoxon* n'a pas encore été définie ; à plus forte raison ne pouvait-il être question d'y faire usage de la notion de degrés d'endoxalité. Corrélativement, dans cette ligne d'interprétation, on essaiera de réduire l'impression que la description initiale et la description finale puissent ne pas décrire le même objet, et l'on s'efforcera de donner de l'expression litigieuse « la dialectique *kath'hautèn* et la peirastique » une interprétation qui préserve l'identité de l'objet décrit, à savoir la dialectique tout court. C'est cette ligne d'interprétation que je voudrais esquisser maintenant.

Il y a d'abord une raison générale de penser que le texte récapitulatif des *Réfutations* n'introduit pas substantiellement de réquisit supplémentaire par rapport au texte programmatique du début des *Topiques*, et, par conséquent, que l'innovation formelle qu'il présente n'est pas destinée à caractériser une forme particulière de la méthode dialectique par opposition à d'autres : c'est précisément que le second texte se présente comme l'exacte récapitulation de l'accomplissement d'un certain programme, qui n'est autre que le programme décrit par le premier (simplement augmenté du programme propre des *Réfutations*, dont Aristote fait discrètement remarquer, en 183b13-15, qu'il ne figurait pas dans le programme initial des *Topiques*). Cette récapitulation se présente explicitement comme telle (183a34-36 : « Il nous reste, après avoir rappelé notre projet initial, à en dire brièvement quelques mots, et à mettre le point final à notre discours »). Elle se déroule conformément à l'annonce qui la précède immédiatement : nous nous proposons, dit Aristote (*proeilometha*, 183a37), une certaine tâche ; cette tâche comportait, pour telles et telles raisons, un certain nombre de sous-tâches. Les diverses sous-tâches ont été successivement accomplies (*dedètôlai*, 183b8, 12 ; *dieleluthamen*, 14) ; à l'heure du bilan, l'auteur peut conclure en s'accordant le *salisfecil* suivant : « il est donc visible que nous avons accompli adéquatement ce que nous nous proposons d'accomplir » (183b15-16).

Tout ceci montre très clairement, je pense, que les différences entre les deux textes, et notamment la substitution des *endoxa* maximaux aux *endoxa* tout court, ne peuvent que très difficilement être interprétées comme l'introduction d'un réquisit supplémentaire, qui caractériserait une forme particulière de la dialectique, par opposition à la dialectique en général et à ses autres formes particulières. Si Aristote avait changé l'objet de sa description, en remplaçant la dialectique en général par l'une de ses espèces particulières, on voit mal comment il pourrait

présenter sa seconde description comme celle de l'accomplissement exact de la tâche décrite par la première.

Un point de discussion plus particulier, sur le même sujet, doit concerner, comme je l'ai dit plus haut, l'interprétation de la formule « la dialectique *kath'hautèn* et la peirastique » (183a39-b1), qui désigne ce dont la tâche est décrite dans le passage des *Réfutations* qui nous intéresse. Bolton traduit, comme nous l'avons vu : « la dialectique au sens strict et la peirastique », et la suite de ses considérations sur la peirastique semble montrer qu'il comprend cette formule dans le sens de « la dialectique au sens strict, et notamment la peirastique », peut-être même dans le sens de « la dialectique au sens strict, c'est-à-dire la peirastique ». En tout état de cause, cette traduction peu orthodoxe de *kath'hautèn* aurait besoin d'être plus précisément argumentée et défendue, en particulier contre des possibilités concurrentes, comme « la dialectique considérée en elle-même » (c'est-à-dire : abstraction faite des différences qui pourraient séparer ses diverses formes ou espèces). Cette possibilité peut elle-même s'accommoder, au moins provisoirement, de diverses hypothèses concernant le statut de la peirastique par rapport à la dialectique « en elle-même ». On peut en effet comprendre, soit « la dialectique en elle-même, et aussi la peirastique », celle-ci étant alors considérée comme extérieure à la dialectique, comme elle l'est dans la présentation du chapitre 2 des *Réfutations* (165a38-39, b3-7) ; soit « la dialectique en elle-même, et notamment la peirastique », celle-ci étant alors considérée comme une espèce ou une partie de la dialectique, comme elle l'est dans le chapitre 8 (169b25) et dans le chapitre 11 (171b4-6). Dans ces diverses hypothèses, entre lesquelles je ne me prononcerai point ici (car je suis moins certain que ne l'est Robert Bolton que l'on puisse réunir en un tableau cohérent toutes les indications que donne Aristote sur le statut de la peirastique), il est en tout cas clair que l'emploi de l'expression de « dialectique *kath'hautèn* » peut avoir été motivé par le souci de souligner que l'objet de la description reste précisément la dialectique « en elle-même », c'est-à-dire abstraction faite de la diversité de ses formes, c'est-à-dire encore *sous toutes ses formes* ; peu importe, à cet égard, que la peirastique mentionnée à côté d'elle soit l'une de ces formes ou qu'elle ne le soit pas. Cette interprétation de la formule litigieuse permet donc de préserver un rapport de stricte adéquation entre le programme initial des *Topiques* et le bilan récapitulatif des *Réfutations* : l'objet décrit ne s'est pas modifié restrictivement d'une description à l'autre.

La distinction dont nous venons de discuter les bases textuelles et conceptuelles opposait, dans l'interprétation de Robert Bolton, une dialectique *ex endoxôn* et une dialectique à exigences plus fortes, *ex endoxotatôn*. Bolton superpose encore à cette opposition celle qui sépare une dialectique qui ne servirait qu'à s'exercer l'esprit et une dialectique

qui aurait vocation d'intervenir sérieusement dans la recherche de la vérité et dans la justification de la connaissance. Suivons maintenant les formes que prend notre débat à ce nouveau plan.

4. DIALECTIQUE GYMNASTIQUE, DIALECTIQUE NON-GYMNASTIQUE

Aristote, on le sait, distingue plusieurs « usages » ou « utilités » de la dialectique, ou plus exactement de son traité de dialectique (*pragmateia*, 101a26), dans le chapitre I 2 des *Topiques*. La première de ces « utilités » est celle d'un entraînement ou d'une gymnastique (*gymnasia*) ; parmi les « utilités » non-gymnastiques figurent diverses formes d'« utilités » scientifiques et/ou philosophiques.

Dans la logique de son interprétation, Robert Bolton est tout naturellement conduit à faire coïncider l'opposition « gymnastique vs. non-gymnastique » avec l'opposition « dialectique *ex endoxôn* vs. dialectique *ex endoxalôn* ». Si la règle qui impose de raisonner à partir de ce qui est le plus *endoxon* était véritablement une règle plus contraignante que celle qui impose de raisonner simplement à partir de ce qui est *endoxon* tout court, il serait effectivement tentant de considérer que la règle la moins contraignante est celle qui gouverne l'usage purement gymnastique de la dialectique, alors que la règle la plus contraignante est celle qui gouverne les usages philosophiquement et scientifiquement intéressants de la méthode dialectique, la « mise à l'épreuve » et la « recherche » (*peira*, *skepsis*, 159a33). Comme le dit Bolton en résumant sa thèse sur ce point, « la dialectique à visée gymnastique a d'autres règles que la dialectique destinée à la 'mise à l'épreuve' et à la 'recherche' ... et la dialectique gymnastique n'a pas toujours nécessairement besoin de raisonner à partir de ce qui est 'plus *endoxon*' » (p. 201).

Remarquons d'abord qu'il semble, au moins à première vue, assez paradoxal de supposer que l'on puisse s'entraîner à une pratique quelconque en observant des règles différentes de celles qui gouvernent cette pratique. On peut cependant admettre que dans certains cas, l'on puisse s'exercer à pratiquer telle ou telle activité en observant des règles moins strictes que celles qu'il faudra respecter lorsqu'on se livrera à cette activité « pour de bon », ou encore en n'observant qu'une partie de ces règles : on s'entraîne au tennis, par exemple, en « faisant des balles », sans respecter toutes les règles qui gouvernent le jeu pendant une véritable partie de tennis. Mais ce modèle n'est pas le seul concevable en la matière, et l'on trouverait sans peine d'autres activités à propos desquelles il serait passablement absurde de prétendre s'entraîner à les exercer sans en observer intégralement les règles.

En ce qui concerne l'exercice dialectique, la question peut donc se poser de savoir lequel de ces deux modèles est pertinent. Je ne pense pas

que l'on puisse durcir l'opposition entre « dialectique gymnastique » et « dialectique non-gymnastique », comme le fait Bolton, au point d'assigner à chacune d'elles des règles différentes, et de les constituer comme deux espèces distinctes, ou deux groupes distincts d'espèces, de la dialectique. Je ne pense même pas qu'il soit tout à fait légitime de parler de « dialectique gymnastique » et de « dialectique(s) non-gymnastique(s) ». Et, soit dit en passant, je crois n'avoir suggéré nulle part qu'aux yeux d'Aristote, la méthode décrite dans les *Topiques* n'ait été appropriée qu'à l'usage gymnastique et scolaire, malgré le reproche que m'adresse Bolton, p. 213.

Il me semble en tout cas que la méthode dialectique à laquelle on s'entraîne dans l'usage « gymnastique » n'est pas une autre dialectique, ou une autre forme de dialectique, ou une dialectique gouvernée par d'autres règles, que celle que l'on pratique, selon les *Topiques* eux-mêmes, à des fins « sérieuses » et non-gymnastiques. Dans le chapitre I 2, Aristote distingue, non pas divers types ou espèces de dialectiques, mais diverses fonctions, usages ou utilités d'une méthode qui est toujours décrite au singulier, dans ses diverses relations avec une multiplicité de fins ou d'objectifs. En ce qui concerne plus particulièrement l'utilité du traité des *Topiques* pour la gymnastique dialectique, Aristote dit même que cette utilité est « de soi évidente » (*ex autôn kalaphanes*), parce qu'« une fois en possession d'une méthode, nous pourrions plus facilement argumenter sur le sujet qui se présente » (101a29-30) ; les autres « utilités » du traité semblent, par contraste, avoir besoin d'explications. Le traité permet donc d'acquérir la technique même dont ces explications montreront l'utilité, non une technique plus faible ou moins exigeante. Et s'il en est ainsi, l'activité à laquelle se livre celui qui s'entraîne à la gymnastique en question n'est pas une autre activité que « la dialectique » (101b2) elle-même, ni une activité gouvernée par des règles différentes ou moins strictes que dans ses autres applications ou usages. S'il en était autrement, Aristote devrait démontrer séparément (1) que son traité permet de s'entraîner à la méthode dialectique, et (2) que cet entraînement est lui-même utile, en dépit de ses règles moins strictes, à l'emploi de cette méthode dans les tâches « nobles » de la science et de la philosophie. C'est pourtant ce dont il n'apparaît nulle part ressentir le besoin.

Bolton présente cependant à l'appui de sa thèse, p. 200, quelques arguments précis qu'il vaut sans doute la peine de discuter. Il met en contraste les deux textes ou ensembles de textes suivants : d'une part, le difficile passage de VIII 3, où Aristote dit que pour celui qui s'entraîne (*gymnazomenô*), par opposition à celui qui apprend (*manthanonli*), il n'est pas nécessaire de respecter la règle qui impose de procéder à partir de prémisses « plus intelligibles » (*gnôrimôleron*) que la conclusion ; d'autre part, les chapitres VIII 5-6, où Aristote demande au contraire de

respecter une règle qui impose de procéder à partir de ce qui est «plus *endoxon*» et «plus intelligible» que la conclusion. Pour éviter d'attribuer une contradiction à Aristote, on devrait supposer que, dans les deux textes, Aristote oppose diverses formes ou espèces de la dialectique : dans le premier, la règle que la dialectique gymnastique peut se dispenser de respecter s'impose, au contraire, à une autre forme particulière de la dialectique, à savoir «une certaine sorte de discussion dialectique qui peut servir d'apprentissage (scientifique)» (note 21); dans le second groupe de textes, symétriquement, la règle du «plus *endoxon*» ne s'impose qu'à une forme particulière de la dialectique, celle qui vise «à l'épreuve et à la recherche» (*peiras kai skepseôs charin*, 159a33), et il est tacitement entendu que la dialectique gymnastique n'a pas à s'en préoccuper.

La question est cependant de savoir si ces textes ou groupes de textes sont véritablement opposables. On peut d'abord observer que le chapitre VIII 3 appartient à un ensemble de chapitres destinés à indiquer au *questionneur* les règles qu'il doit observer pour formuler et mettre en ordre ses questions (cf. VIII 1, 155b3, 18, et la clause de terminaison en VIII 4, 159a15-16), alors qu'à partir du début du chapitre 4, Aristote passe aux directives destinées au *répondant* (159a16 ss). Quel que soit le sens exact de la difficile fin du chapitre VIII 3, il est donc exclu, me semble-t-il, que l'on puisse l'utiliser pour dire qu'Aristote impose au *répondant* tantôt une règle plus lâche, tantôt une règle plus stricte, contradiction qui ne pourrait se résoudre qu'en supposant qu'il a en vue, ici et là, diverses formes ou espèces de dialectique qui n'obéissent pas aux mêmes règles.

Voyons maintenant plus précisément si les textes cités imposent l'idée d'une division de la dialectique en espèces distinctes. Dans le premier (3, 159a11-14), Aristote oppose l'entraînement gymnastique (*lôi gymnazomenoi*) à l'apprentissage (*lôi manthanonti*). Pour expliquer comment il comprend ce contraste, Bolton procède en deux étapes. Dans un premier temps (note 17), il dit que la question de savoir si la procédure destinée à l'apprentissage est ou non considérée ici comme une espèce de procédure dialectique mérite discussion, mais que cette question peut être provisoirement laissée de côté, car de toute façon, le texte décrit clairement ce qui n'est pas requis dans la dialectique gymnastique, à savoir le respect de la règle *dia gnôrimôlerôn*. Dans un second temps (note 21), il revient sur le problème qu'il avait provisoirement laissé ouvert, et propose de le résoudre en disant qu'Aristote a ici en vue «une certaine espèce de discussion dialectique qui peut être utilisée pour l'apprentissage».

Concernant le premier point, il me semble que Bolton commet une sorte de pétition de principe : en parlant de «dialectique gymnastique», il présuppose ce qui est précisément à démontrer, à savoir qu'il existe

une «dialectique gymnastique» qui s'oppose à d'autres «dialectiques» ou espèces de «dialectiques». Il n'est pas du tout indifférent, même provisoirement, que «l'apprentissage» du *manthanôn* soit ici conçu ou non comme une espèce de procédure dialectique : car s'il ne l'est pas, l'opposition entre «apprentissage» et «entraînement» met en contraste une procédure *non-dialectique* d'enseignement et une procédure *dialectique* d'entraînement, et l'on doit conclure que la notion d'«entraînement» ou de «gymnastique» suffit ici à caractériser la dialectique *comme telle*, dans le contexte de son opposition avec les procédures didactiques. Que la «gymnastique» puisse passer ici pour l'emblème de la dialectique elle-même, cela ne me paraît nullement impossible, si l'on veut bien considérer (1) que l'opposition «apprentissage vs. entraînement» se superpose, dans le contexte immédiat, à l'opposition «enseignement vs. interrogation» (*erôtônli te kai didaskonli*, 159a13), laquelle renvoie elle-même à une opposition classique entre enseignement scientifique-démonstratif et interrogation dialectique (SE 2, 165b1-3; 11, 172a15 ss; APr I 1, 24a22 ss; cf. aussi Top. VIII 1, 155b10-16); (2) qu'il arrive à Aristote d'utiliser la notion de «gymnastique» pour déterminer une caractéristique qui appartient selon lui à la méthode des *Topiques* comme telle (cf. par exemple I 11, 105a9 : un problème dont la solution serait trop longue ne doit pas faire l'objet d'un examen, car il comporterait «plus de difficulté qu'il ne convient à un exercice gymnastique»); (3) enfin, que la règle *dia gnôrimôlerôn*, telle qu'elle est ici imposée à la procédure d'enseignement-apprentissage, n'associe pas à la notion de «plus intelligible» la notion de «plus *endoxon*»; il y a donc de bonnes chances que le «plus intelligible» qu'Aristote a ici en vue (comme en 155b10-16) soit le «plus intelligible *en soi*», et non pas le «plus intelligible *pour nous*», lequel (comme le montre fort bien Bolton, pp. 207-208) est le seul des deux qui puisse être associé positivement à l'*endoxon* dialectique (comme il l'est dans des passages comme 159b8-9 et 13-15).

S'il en est ainsi, on comprend pourquoi je résiste à l'argumentation de Bolton dans son second temps (note 21). Nulle part Aristote ne dit que la procédure complexe décrite dans des textes comme le chapitre VIII 8 (à savoir une procédure où les prémisses demandées par le questionneur «ne sont pas simplement acceptées ou rejetées par le répondant, mais soumises à objection et à examen dialectique») soit une procédure inappropriée lorsqu'on pratique la dialectique à des fins purement gymnastiques. Les complexités du «give and take» dialectique (objections, contre-instances, contre-attaques, etc.), décrites par Bolton dans la section 6 de son étude en termes parfois discutables, mais souvent indiscutables, sont analysées par Aristote dans le cadre de ses instructions générales au répondant, instructions qui visent à différencier la dialectique comme telle de deux territoires qui lui sont limitrophes, la didactique et l'agonistique, et qui ne prennent pas en

compte les différences entre les divers usages de la dialectique. On ne peut donc pas assigner ces procédures à une dialectique didactique qui s'opposerait, à l'intérieur du genre dialectique, à la dialectique gymnastique ; il me semble arbitraire d'invoquer sur ce point le passage 159a11, comme le fait Bolton dans sa note 21 ; et la tentative que contient cette même note pour différencier cette didactique intra-dialectique de la didactique extra-dialectique décrite par Aristote dans des textes comme le chapitre 2 des *Réfutations* m'apparaît comme un expédient désespéré. On ne peut pas non plus soutenir, avec des textes à l'appui, que ces procédures soient inappropriées quand on pratique la dialectique à des fins purement gymnastiques, et qu'elles n'ont leur place que dans une forme « sérieuse » et épistémologiquement respectable de dialectique, celle qui vise à la *peira* et/ou à la *skepsis*.

Le chapitre VIII 5, où Aristote introduit ses instructions à l'usage du répondant, permet en effet de vérifier avec précision que son objectif est de marquer les différences qui séparent la dialectique, prise en tant que telle et dans son unité, et les activités voisines dont il importe de la distinguer, à savoir le dialogue didactique et le dialogue agonistique. Revendiquant sur ce point particulier un rôle de pionnier (159a36-37), Aristote indique que la tâche du répondant dialecticien n'a jamais été bien définie, contrairement à celle du répondant dans un dialogue didactique (où il doit toujours répondre conformément à ce qu'il pense, 159a29) et à celle du répondant dans un dialogue agonistique (où il doit toujours s'efforcer de ne paraître subir aucun dommage, 159a32). Entre ces deux extrêmes de la bonne foi sans limites et de la mauvaise foi systématique, Aristote veut définir, pour la première fois, les règles d'après lesquelles le répondant, dans un entretien proprement dialectique (tous « usages » confondus), doit accepter ou rejeter les prémisses qui lui sont proposées par le questionneur.

Je cours ici le risque, à vrai dire, que l'on me fasse une objection : en effet, les fins propres de la dialectique, dans ces premières lignes du chapitre VIII 5, sont désignées successivement par des expressions variées : *gumnasias kai peiras heneka* (159a25), *skepseôs charin* (28), *peiras kai skepseôs* (sc. *charin*) (33). Pourquoi ces variations, dira-t-on, si elles ne sont pas destinées à différencier par leurs fins diverses espèces de l'activité dialectique ? Je crois cependant qu'on peut y voir diverses façons de se référer, par des descriptions qui mettent alternativement en jeu telle ou telle de ses finalités, une seule et même activité, la dialectique en tant que telle. Les échos partiels que ces expressions se renvoient les unes aux autres en sont déjà l'indice. Si, par exemple, Aristote voulait opposer radicalement l'usage gymnastique (*gymnasia*) et l'usage « examinateur » (*skepsis*) de la dialectique, il serait singulièrement maladroit de sa part de brouiller la netteté de cette opposition en associant, à quelques lignes d'intervalle, chacun de ces deux termes à un

même troisième, à savoir *peira*. Le sens de ces variations est à chercher, en réalité, dans des considérations de contexte. En 159a25, le terme de *gymnasia* figure dans la description des fins de la dialectique, très vraisemblablement, parce que c'est ce terme qui implique l'opposition la plus nette entre la dialectique et le dialogue didactique, et qu'à cet endroit précis, c'est cette distinction qu'il importe de mettre en lumière (26-27, cf. 161a25) ; en 159a28 et 33, c'est au contraire le terme de *skepsis* qui sert, seul ou en combinaison, à déterminer l'essence de la dialectique, parce que c'est ce terme qui implique l'opposition la plus nette entre la dialectique et le dialogue agonistique ou polémique, et qu'à cet endroit précis c'est cette autre distinction qui est thématifiée (159a27 et 33).

La structure générale du paragraphe et de la longue parenthèse explicative qui en occupe la plus grande partie (159a26-26) confirmerait encore, à mon sens, cette analyse. Cette structure se présente en effet ainsi :

(1) Les règles à l'usage des répondants sont indéterminées, pour ceux qui argumentent en vue de la *gymnasia* et de la *peira*.

(2) *En effet*, les buts ne sont pas les mêmes pour ceux qui enseignent ou apprennent et pour ceux qui polémique, et ils ne sont pas non plus les mêmes pour ceux-ci (c'est-à-dire l'ensemble de ceux dont il vient d'être question) et pour ceux qui discutent entre eux à des fins de *skepsis*.

(3) *En effet*, d'une part, celui qui apprend sait quelle règle il doit suivre ; d'autre part, ceux qui polémique le savent aussi ; *mais* dans les rencontres *dialectiques*, pour ceux qui argumentent non en vue de l'*agôn*, mais en vue de la *peira* et de la *skepsis*, on n'a pas encore articulé clairement les objectifs que doit viser le répondant, ni les règles qu'il doit suivre dans ses réponses.

(4) Puisqu'il n'existe pas de tradition sur ce point, essayons donc d'en dire nous-mêmes quelque chose.

On le voit clairement, je crois : le raisonnement n'offre une trajectoire satisfaisante que si l'on suppose qu'à travers les variations de son expression, Aristote garde ici en vue une activité unique, l'activité dialectique en tant que telle, qu'il s'agit de différencier par rapport à ses voisines extra-dialectiques, la didactique et l'agonistique ; les descriptions sous lesquelles il est fait référence à la dialectique varient en fonction des différentes délimitations qu'il s'agit de souligner successivement. On rendrait incompréhensible, en revanche, le déroulement du discours aristotélicien dans ce passage si l'on croyait qu'à chaque description différenciée de la dialectique correspond un objet différencié, à savoir une sous-espèce différenciée de cette même dialectique.

5. EN GUISE DE CONCLUSION PROVISOIRE

Il est temps de conclure cette série de remarques, qui n'ont certainement pas atteint le fond du débat. Celui-ci se situerait, je pense, au niveau des rapports entre l'utilité gymnastique de la méthode des *Topiques* et son utilité philosophique et scientifique. La tendance générale de l'interprétation de Robert Bolton est de marginaliser, au moins relativement, l'usage gymnastique de la méthode des *Topiques*, et, du même coup, de neutraliser tous les aspects de la dialectique aristotélécienne qui lui sont liés (codification des rôles dialectiques du questionneur et du répondant, institutionnalisation scolaire du dialogue, postulat de la non-contradiction des *endoxa*) ; c'est seulement à ce prix, selon lui, que l'on peut comprendre que la méthode puisse avoir une utilité qui ne soit pas seulement gymnastique, et que l'on puisse passer sans heurt de son usage philosophique, tel qu'il est décrit dans les *Topiques*, à la pratique de cet usage philosophique dans les traités. Je pense, pour ma part, que l'usage philosophique de la dialectique, selon l'auteur des *Topiques*, est solidaire de son usage gymnastique, plus qu'il ne l'est de l'usage philosophique (futur) qui en sera fait dans les traités. Mais il serait trop long de s'expliquer là-dessus, à cause en particulier du soupçon de couches rédactionnelles distinctes que l'on peut avoir par rapport au chapitre I 2 (cf. *eli de* en 101a36). J'aurai sûrement d'autres occasions de poursuivre avec Robert Bolton une discussion dont j'ai déjà tiré grand profit. Pour finir sur quelque chose de plus beau et de plus significatif que mes laborieux commentaires, je me contenterai de rappeler (même si je ne remplis pas toutes les conditions pour le suivre) le célèbre conseil que donne Parménide à Socrate dans le *Parménide* platonicien (135d), conseil que tous les exégètes, depuis Alexandre d'Aphrodise, ont rapproché non sans raison des *Topiques* aristotéliens : «exerce-toi, entraîne-toi dans cette activité qui a l'air d'être inutile et que la plupart des gens appellent du bavardage, tant que tu es encore jeune ; sinon, la vérité t'échappera».

COMMENTS ON ROBERT BOLTON'S *THE EPISTEMOLOGICAL BASIS OF ARISTOTELIAN DIALECTIC*

DANIEL DEVEREUX

Aristotle mentions in a fragment that Zeno was the discoverer of dialectic.¹ It was Plato, however, who gave the activity its name, using the term *dialektikê* to refer to the special method of inquiry characteristic of the philosopher. In the *Republic* dialectic is tendentiously linked to the theory of separate, paradigmatic forms: to be a dialectician, or philosopher for that matter, is to be an adherent of Platonic forms.² In later dialogues we find a less partisan view. The dialectician is concerned with unchanging forms, but there is no requirement that these forms serve as paradigms or exist separately from their instances.³ Plato may still have been an adherent of Platonic forms, but professing allegiance to this doctrine is no longer a condition of being a dialectician or philosopher. The metaphysical commitments are relaxed to the point where there is room for a good deal of disagreement among dialecticians regarding the nature and status of forms; even such young upstarts in the Academy as Aristotle may qualify as dialecticians. What remains constant through Plato's dialogues is the

(1) Aristotle, *Soph.*, fr. I Ross. In the *Metaphysics* (987b29-33, 1078b17-30) Aristotle implies that dialectic originated with Socrates and Plato, but in these passages he seems to be using the term in its specific Platonic sense, designating a systematic method for the discovery of the essences of things. In the *Parmenides* (135c-136c), Plato attributes to Zeno a method of discussion that is at least a close cousin of his dialectic; the Zenonian type of discussion is recommended as an exercise that will help to prepare the young Socrates for the attempt to define such notions as the "beautiful", the "just" and the "good".

(2) See, e.g., 532a-b, 533c-d, 510a-511e.

(3) *Parmenides* 135b-c, *Sophist* 253c-254a, *Philebus* 57e-58a.

exalted position of dialectic in relation to other disciplines. Its objects are primary in the sense of being most intelligible and prior to the objects of other sciences or disciplines. In the late dialogues as well as in the *Republic*, to be a philosopher is to be an accomplished dialectician.

In spite of the fact that Aristotle devoted an entire treatise to the subject of dialectic, its role or function in his philosophy is not at all clear. The array of views on this question held by recent commentators is nothing short of bewildering. Some argue that Aristotle retains the Platonic conception of dialectic as *the* method of philosophical inquiry; not only is it the preferred method in dealing with subjects that do not admit of scientific demonstration, e.g. ethics and metaphysics, but even in the sciences it provides the only possible justification for their first principles and undergirds our confidence in scientific procedures and methods.⁴ At the other extreme are those who contend that Aristotelian dialectic is a rule-governed method of discussion whose aim is simply to increase one's ability to argue effectively on both sides of a question.⁵ According to this view, dialectic has no concern for getting at the truth and has no role in a properly philosophical or scientific inquiry. One naturally wonders how these two groups can be talking about the same thing; moreover, if the second view is correct, one wonders why Aristotle would use the term "dialectic" for an activity that seems to have so little in common with its Platonic namesake.⁶

(4) M. Nussbaum, *Fragility of Goodness*, 240-58.

(5) See, for example, P. Moraux, "La joute dialectique d'après le huitième livre des *Topiques*", in G.E.L. Owen, ed., *Aristotle on Dialectic* (Oxford, 1968), 288-9; also J. Brunschwig, "Aristotle on Arguments Without Winners or Losers", *Wissenschaftskolleg Jahrbuch* 1984/5 (Berlin, 1986), 40. Moraux and Brunschwig are of course aware that in *Topics* I 2 dialectic is said to be useful in relation to the "philosophical sciences" (see Moraux, 311, Brunschwig, 34). Their view seems to be that whatever the philosophical utility of dialectic might be, it is not discussed in the *Topics* and does not seem to have influenced the description of the method of conducting dialectical discussions in Book VIII. Although they do not say so, it seems likely that Moraux and Brunschwig would regard the claim about the philosophical utility of dialectic as problematic, given their view that dialectical discussions have no concern for truth as such.

(6) A number of commentators believe that Aristotle composed the *Topics* during the period he was a member of the Academy. If so, the contrast between Aristotle's and Plato's conceptions of dialectic is an interesting indication of the range of disagreement tolerated in the Academy at this time. If we suppose that the procedures described in *Topics* VIII have some resemblance to actual practices in the Academy (notice that 101a26-30 seems to presuppose that "dialectical exercises" already take place; Aristotle's treatise will be useful to participants in these exercises), it is difficult to believe that Plato would have regarded such discussions as examples of dialectical inquiry; perhaps he would have considered them a useful propaedeutic to dialectic (cf. *Parmenides* 135c-136c), but no more than that. Aristotle came to believe, on the other hand, that proficiency in such discussions was the mark of a dialectician. Moraux suggests that within the *Topics* we can see evidence of an evolution from a Platonic to an Aristotelian conception of

It seems to me that these two groups of commentators are *not* talking about the same thing. Certainly the texts they regard as crucial for their views are not the same and, as I will try to indicate later, it is not at all clear that both sets of texts are concerned with what Aristotle calls "dialectic".

Between the two extreme views we have mentioned there are of course a number of intermediate positions that have been staked out and argued for by scholars, both recent and not so recent. Robert Bolton's view is an example of one of these more moderate positions. He argues that the second extreme view is correct in regard to the kind of dialectic Aristotle is mostly concerned with in the *Topics*. The sort of organized discussion or debate that is in the forefront of the discussion in this work is what might be called "gymnastic" dialectic. The point of this kind of discussion is to train the participants to argue effectively — whatever the topic — on the basis simply of opinion or what seems plausible. The participants in such discussions are not supposed to be concerned with the truth of either the premises or the conclusions of their arguments. In view of these characteristics, one can easily understand why gymnastic dialectic would have no role in philosophical or scientific inquiry. However, according to Bolton, there is another kind of dialectic, called "peirastic", which is discussed most clearly in the *Sophistical Refutations*, but also alluded to at various points in the *Topics*. In peirastic dialectic one is concerned with truth; Bolton argues that it is a requirement that the premises of peirastic arguments be true. And since this form of dialectic relies on what is commonly known to be true (*la koina*), it will be useful for the testing of scientific or philosophical hypotheses.

So the weakness of the second extreme view — the view that dialectic has no role in philosophical or scientific inquiry — is that it focuses exclusively on one form of dialectic, "gymnastic" dialectic, and ignores peirastic dialectic, a form well suited for testing theories or hypotheses. But peirastic provides only one way of testing theories; an equally (if not more) important way is by appeal to data derived from perceptual observation. When first discovered, such data will not

dialectic. The main body of the work, Books II-VII, reflects a Platonic view of dialectic as a method of inquiry aimed at the discovery of essences and definitions; it is only in the later sections (Books I, VIII) that we find the contrast between philosophy and dialectic and the related contrast between arguments *kata doxan* and *kal' alêtheian*. On the chronological stratification of the *Topics* and *Sophistical Refutations*, see the interesting and generally plausible suggestions of H. Maier, *Die Syllogistik des Aristoteles*, 112 (Tübingen, 1900), 78, n. 3 (78-82); also J. Brunschwig, *Aristote: Topiques*, I-IV (Paris, 1967), LXI-LXXXIII, and J. Barnes, "Proof and Syllogism", in E. Berti, ed., *Aristotle on Science: The Posterior Analytics* (Padua, 1981), 43, n. 43. For further remarks on chronology, see below, n. 19.

qualify either as *endoxa* or as things commonly known to be true, and thus will not fall within the scope of peirastic testing. Dialectic, or more exactly peirastic dialectic, is therefore not the only, or even the most fundamental, method of philosophical or scientific inquiry, as the first extreme view would have it.

Before beginning our test of *this* hypothesis by examining the relevant texts in the *Topics* and *Sophistical Refutations*, I should perhaps indicate some general points of agreement and disagreement with Bolton's interesting and valuable discussion. I am not persuaded that Aristotle recognizes in these works a special form of dialectic intended for use in philosophical inquiries. As will become clear shortly, my understanding of the nature and function of peirastic is quite different from Bolton's. On the other hand, I believe Aristotle regarded dialectic as useful to philosophy, even if it is not a method to be used in philosophy. Its philosophical utility is only partly a matter of improving one's mental acuity; the *results* of dialectical discussions may also be useful, as we shall see. Although the differences that will emerge between my view and Bolton's are substantial, I believe our overall positions are fairly close, at least when compared with the extreme views held by recent commentators.

I

Bolton argues that there are indications in *Topics* VIII that Aristotle distinguishes between two forms of dialectic, one used for mental training or "gymnastics", the other for "testing and inquiry" (200). In the case of the former, the premises must be plausible (*endoxa*)⁷ but they need not be more plausible than the conclusion and

(7) "Plausible views" seems to me at least a defensible translation of *ta endoxa* in the *Topics* ("plausible" for the adjective *endoxos* as a modifier of opinions or premises). Barnes prefers "reputable views" as a translation, chiefly because the original meaning of the adjective *endoxos* is "of good repute" (see "Aristotle and the Methods of Ethics", *Revue Internationale de Philosophie* [1980], 498-500). It is true that "plausible" lacks the etymological connection, but it is not clear that Aristotle has this connection in mind. Consider, for example, the passage in I 10 where dialectical premises (or *endoxa*) are characterized as views held by all or by most or by the wise—either by all of the wise or by most or by the most notable, provided these are not contrary to general opinion (*mé paradoxos*): "for a man would grant (*theîê gar an tis*) a view held by the wise if it does not conflict with generally held opinions" (104a8-12). Thus the reason for including the (nonparadoxical) opinions of the wise among *ta endoxa* is the fact that an individual could be expected to grant such opinions in a discussion (cf. 104a33-35: opinions "in accordance with the arts" count as *endoxa* or dialectical premises "for a man would grant views held by those who have made a study of these things"). The operative notion seems to be what an interlocutor could reasonably be expected to accept in a discussion, or what it would be unreasonable or churlish for an interlocutor to refuse to accept without offering a

they need not be true; in the case of the latter, the premises must be both true and more plausible than the conclusion — they must indeed be "as plausible as possible", i.e. there should not be other more plausible premises from which the conclusion follows. Bolton bases his claim that in gymnastic dialectic the premises need not be more plausible than the conclusion on the following passage in VIII 3:

One must be aware then, whenever a thesis is hard to argue against, that one or other of the aforesaid things has happened to it. Whenever, on the other hand, it is a harder task to argue for the claim or proposition [you need] than against the thesis, a doubt may arise whether such claims should be granted or not; for if a man is going to refuse to grant it and demand that it be argued for, he will be prescribing a harder task than was originally proposed; if, on the other hand, he grants it, he will be convinced on the strength of what is less convincing. If, then, one ought not to increase the difficulty of the [original] problem, it should be granted; if, on the other hand, one ought to deduce through premises that are more familiar (*gnôrimôlerôn*), it should not be granted. In other words, it should not be granted by one who is learning (*lôî manthanonli*) unless it is more familiar; but it should be granted by one who is training (*lôî gumnazomenôî*) as long as it appears true. Clearly, then, the circumstances under which admissions should be claimed are different for a questioner and a teacher. (159a3-14).

supporting argument. "Reasonable expectation" is determined at least in part by social context; Aristotle is assuming a discussion between two individuals before an audience, and the social setting imposes certain constraints on the behavior of the interlocutors (*Endoxa* "may be true, of course, ... but it is not their truth, as such, which is of interest to the dialectician, but rather their social undeniability"; Brunschwig, "Arguments", 33; cf. 160b2-6, 158a7-13, SE 169b30-34, 175b33-36; cf. Moraux, *op. cit.*, 277-8). The term "plausible" is constantly used in the context of informal argument, and its use corresponds closely to the idea of what it would be reasonable to grant to an interlocutor in a certain social setting of discussion. (It is also worth noting that Barnes translates the opposite of *endoxos*—*adoxos*—as "implausible" in the Revised Oxford Translation: see, e.g., VIII 5.)

It might be argued, on the other side, that Aristotle's *endoxa* include more than just the views one could be expected to grant in a discussion; for in his initial characterization of *endoxa* (100b21-23) he includes views held by the wise without qualification, but, as we have seen, he holds that only *non-paradoxical* views of the wise could be expected to be granted in discussion. One might also point out that at 104a8-12 Aristotle is specifying the class of "dialectical premises", not the class of *endoxa*, so this passage should not be taken as an indication of what is meant by the term *endoxa*. According to this view, the premises of dialectical arguments form a subclass of *ta endoxa*, and we should take 104a8-12 as a correction of the suggestion at 100a29-30 that the class of dialectical premises coincides with the class of *endoxa*. However, 104a8 ff. is usually taken as a fuller specification of the class of *endoxa* (see Brunschwig, *Topiques*, 113-4; Barnes, "Methods", 501); if so, we must understand it as a correction of the suggestion at 100b21-23 that opinions of the wise in general—whether or not they are paradoxical—count as *endoxa*. (It is usually thought that Socrates' denial of *acrasia* is treated as one of the *endoxa*, even though it clearly conflicts with general opinion—*amphisbêlei lois phainomenois enargôs*; *Nic. Ethics* 1145b25-28; cf. *Top.* 105a35-b1, and Brunschwig, *Topiques*, 130, n. 5. However, Socrates' view is mentioned *after* the *endoxa* or *phainomena* have been set forth [1145b8-20, esp. line 20], and within the second stage of the inquiry, i.e. the development of the *aporiai* [cf. 1145b2-4 with b20-22 and 1146b6-8].)

Thus in the case of dialectical discussions for the sake of training, i.e. what Bolton calls "gymnastic dialectic", the premises need not be more familiar or more plausible⁸ than the conclusion. By contrast, in a discussion between teacher and student, the premises must be more familiar. Now it would be wrong to suggest that discussion between teachers and students is a type of dialectic with stricter standards than gymnastic dialectic.⁹ In VIII 5, Aristotle distinguishes between dialectical discussions and discussions among those engaged in teaching or learning. The latter type of discussion is not a type of dialectic at all. How do we know, then, that there is a type of dialectic, different from gymnastic, which requires that premises be more familiar or more plausible than the conclusion? Bolton points out that in VIII 5 and 6 Aristotle says that an answerer in a dialectical discussion should only grant to the questioner what is more plausible and more familiar than the conclusion to be established.

...the premises secured by the questioner should all be plausible, and more plausible than the proposed conclusion, if the less familiar is going to be inferred through the more familiar. (159b13-15).

Those who try to deduce from premises more implausible than the conclusion clearly do not deduce correctly; hence these should not be granted to questioners. (160a14-16)

When we compare these passages with the passage in VIII 3, we seem to be faced with two options: either (i) Aristotle is here contradicting what he said earlier, or (ii) he is thinking of a different form of dialectic — one with more stringent rules than gymnastic dialectic.¹⁰ Bolton of course recommends the second option.

If Aristotle does recognize a second form of dialectic which requires that premises always be more plausible than the conclusion argued for, it is odd that he does not mention it in the passage in chapter 3; he ought to be contrasting gymnastic dialectic not only with discussion for the sake of teaching and learning but also with this stricter form of dialectic, for they both require that premises be more familiar than conclusions. I believe that in all of these passages Aristotle is speaking of one particular type of discussion which he calls "dialectical". It

(8) As Bolton shows (205-208), what is more familiar or more intelligible (*gnōri-mōteron*) to us (but not simply) corresponds to what is more *endoxon*; see 159b6-15.

(9) In n. 21, Bolton suggests that there is a kind of dialectical discussion used in teaching and learning, though it is different from the learning procedure described in *SE* 2, 165b1-3. But it should be noted that in *Top.* VIII 5, 159a26-32, discussion between teacher and student is *contrasted* with dialectical and eristical discussions, and other references to didactic discussion are consistent with such a contrast; cf. 159a11-14, 161a24-33; *Rhet.* 1355a21-29.

(10) It is clear from the introduction to these passages (159a-32b1) that Aristotle is setting out guidelines for dialectical, not didactic, discussions.

should be noted that he does not use an expression corresponding to "gymnastic dialectic": nowhere in the *Topics* do we find the noun *dialektikē* modified by an adjective indicating a particular type or use of dialectic. When he contrasts dialectical with other types of discussion in VIII 5, he refers to the former as "discussions for the sake of training and examination (*gumnasias kai peiras*)", or "discussions for the sake of examination and inquiry (*peiras kai skepseōs*)", and there is no explicit indication that these descriptions pick out different types of dialectic.¹¹ When Aristotle stipulates in chapters 5 and 6 that the answerer should grant to the questioner only premises that are more plausible and more familiar than the conclusion, there are no signs in the context that he means this to apply to a particular type of dialectic rather than to dialectical discussions in general. He seems to be setting up a general rule for all dialectical discussions.

If we look again at the problematic passage in chapter 3, it is clear, I think, that Aristotle is not implying that there is a type of dialectic which allows premises to be less plausible than the conclusion. He is envisioning a special situation in which, as he puts it, "it is a harder task to argue for the claim or proposition [you need] than against the thesis". The difficulty he mentions is a difficulty for the questioner; the task of the questioner is to refute the answerer's thesis by establishing its contradictory. When he says that it is sometimes a harder task to argue for the claim or proposition than against the thesis, what he seems to mean is that the questioner may find it harder to establish one of the premises he needs for his conclusion than it would be to establish the conclusion once that premise is granted. And it is important to note that this difficulty for the questioner is not one that was foreseen at the outset of the discussion — "for if [the answerer] refuses to grant [the premise] and demands that it be argued for, he will be prescribing a harder task *than was originally proposed*". Is it fair to impose this extra burden on the questioner? Aristotle's decision is that, while it would be appropriate in a teaching situation to demand an argument for the questionable premise, it would not be appropriate in a discussion "for the sake of training"; the premise should be granted "as long as it appears true".¹²

(11) See H. Maier, *op. cit.*, II, 2, 67, n. 1.

(12) Aristotle here shows a concern that the tasks facing the questioner and answerer should be roughly equal in difficulty. Another example of this concern may be seen in VIII 5. Suppose the thesis to be defended by the answerer is very plausible; this means that the contradictory of that thesis, which the questioner must try to establish, will be implausible and thus the questioner's task would seem much more difficult than the answerer's. Aristotle stipulates that in such cases the answerer should grant to the questioner even premises that are implausible, as long as they are less implausible than the conclusion the questioner is trying to establish (159b16-19). In discussions of this kind, it

I think it is clear from the context that Aristotle regards this as an exceptional situation. In the normal case, the tasks of the questioner and answerer are more equally balanced, and the questioner will be able to find premises that are either more plausible than the conclusion or at least easier to argue for. Aristotle is not telling us that *whenever* we are engaged in a dialectical discussion for the sake of training we need not observe the rule that premises must be more plausible than conclusion; he is saying that although in general our premises should be more plausible or more familiar, in this exceptional situation they need not be. It is also worth noting that in the situation envisioned, in which one of the premises granted is less plausible than the conclusion, it is not the case that there is another more plausible premise that can do the job; the questioner still achieves the goal of arguing from premises that are "as plausible as possible" in the given case.¹³ I conclude that the problematic passage in chapter 3 provides no clear support for the view that there are two forms of dialectic. As far as I can see, we search the *Topics* in vain for a distinction between forms or types of dialectic.

II

Perhaps Bolton would agree with this much: the evidence in the *Topics* for a special type of dialectic adapted for use in scientific and philosophical inquiry is rather skimpy and of dubious value, at least in comparison with what we find in the *Sophistical Refutations* (*Sophistici Elenchi: SE*). In several places in this work Aristotle discusses a type of inquiry or argument which he calls *peirastikê*, and at one point he refers to it as a "part" (*meros*) of dialectic.¹⁴ According to Bolton, peirastic arguments are distinguished from ordinary dialectical arguments by two main features: (i) their premises must be not just plausible (*endoxa*), as in ordinary dialectic, but "most plausible" (*endoxalala*); (ii) their premises are things known by people in general, and hence are true, whereas the premises of ordinary dialectical arguments need not be true.¹⁵ If this is right, it seems plausible to suppose that peirastic is

is desirable that the answerer's thesis should be neither very easy nor very difficult to defend (cf. 105a7-9 with 158a31-b15). Although, as Brunschwig points out, dialectical discussions are "arguments without winners or losers", they nevertheless contain features characteristic of what we might call a fair contest. It seems reasonable to suppose that Aristotle builds in these features in order to make dialectical discussions more like a game that is interesting and enjoyable to its participants.

(13) Thus it seems to me that Bolton is wrong in suggesting (at 201) that VIII 3, 159a10-14 waives the requirement that premises be "as *endoxon* as possible".

(14) 169b25; cf. 171b4-6.

(15) The claim that the premises of peirastic arguments must be "most plausible" (*endoxalala*) is based on SE 183a37-b1 ("We set out to discover a faculty of reasoning

more than a mere instrument for exercising the mind. If peirastic arguments proceed from things known, their primary concern must be truth, not opinion. Surely arguments of this sort would have a role in scientific or philosophical inquiry.

There is an immediate problem with Bolton's characterization of peirastic arguments which raises doubts about his interpretation. The combination of the two distinctive features of peirastic premises implies a correlation between plausibility and truth such that any member of the set of "most plausible" views must be true. But it seems possible for a view to be as plausible (or *endoxon*) as one likes and still be false. More to the point, since our immediate concern is the interpretation of Aristotle, we might wonder whether *he* held such a view. Bolton apparently thinks he did not, for he says at one point that for Aristotle a premise may be "most plausible" and at the same time false.¹⁶ Are we to say, then, that Aristotle's characterization of peirastic arguments is inconsistent with his view of the relationship between plausibility and truth? Clearly we need to examine carefully the evidence offered by Bolton in support of his interpretation of peirastic.

Aristotle's conception of peirastic is interesting in its own right, quite apart from the question of its role, if any, in philosophical inquiry. What I propose to do is to comment on the three or four passages in the *SE* in which peirastic is discussed, pointing out along the way my differences with Bolton. A couple of the passages are notoriously difficult, and I am not confident that my interpretations are much more than stabs in the dark.¹⁷

about any given question on the basis of the most plausible premises possible; for this is the function (*ergon*) of dialectic proper (*dialektikês kath' hautên*) and of peirastic."; see Bolton, 199, 234. The characterization of dialectical and peirastic arguments at SE 2, 165b3-6 might be taken to imply that the premises of peirastic arguments need not be *endoxa*. Bolton argues against this, appealing both to 183a37-b1 and to the fact that peirastic is described as a part or type of dialectic. The claim that the premises of peirastic arguments must be true is based on Aristotle's statement that such arguments rely on *koina*, i.e. things commonly known; if the premises of peirastic arguments are things known by all, they must be true and must also be believed (this explains why it is said at 165b2 that peirastic premises are views held by the answerer); see 48-50. E. Weil also holds that peirastic is a special form of dialectic designed for use in scientific or philosophical investigations, though he does not try to support his view in detail in the way that Bolton does; see "La place de la logique dans la pensée aristotélicienne", in *Revue de Métaphysique et de Morale* (1951), 283-315, at 302 (English translation in Barnes, Schofield, Sorabji, eds., *Articles on Aristotle*, vol. I [London, 1975], 88-112, at 99).

(16) See pp. 32, 64.

(17) Moraux believed that Aristotle's comments about peirastic in the *SE* do not add up to a coherent view of its nature and relationship to dialectic; see *op. cit.*, 388, n. 3; cf. Brunschwig, "Arguments", 35.

In chapter 2 of the *SE* Aristotle distinguishes four types of arguments conducted through dialogue (*en toi dialegesthai*), peirastic being one of them.

There are four types of arguments used in discussions between two interlocutors: didactic, dialectical, peirastic and contentious (*eristikoi*). Didactic arguments are those that deduce from the principles appropriate to each subject and not from the opinions held by the answerer (for the learner must take on trust); dialectical arguments are those that deduce from plausible premises (*endoxôn*), to the contradictory of a given thesis; peirastic arguments are those deduced from premises held by the answerer and which anyone who claims to possess the knowledge is bound to know (in what manner is explained elsewhere); contentious (or eristic) arguments are those that deduce or appear to deduce a conclusion from premises that appear to be plausible but are not so. (165a38-b8).

The parenthetical comment, "in what manner is explained elsewhere", would seem to indicate that a fuller explanation of peirastic arguments was given in another text which unfortunately has not survived.¹⁸ This would explain the rather cryptic character of the account we are given. The premises of peirastic and didactic arguments are in one respect opposites: the former are, while the latter are not, opinions or views held by the answerer.¹⁹ Dialectical premises may or may not be

(18) A note at the bottom of the Oxford translation (retained in the Barnes-Lawrence revised version) refers the reader to *Topics* VIII 5, but nothing in that chapter helps to explain the characterization of peirastic premises given here. At 165b9-10 Aristotle mentions that dialectical and peirastic arguments are "discussed elsewhere" (*en allois*). Dialectical arguments are of course discussed in the *Topics*, but the treatise as it has come down to us contains no discussion of the kind of argument here referred to as peirastic. Perhaps when Aristotle wrote this passage, he planned to revise the *Topics*, so as to include a discussion of peirastic arguments but he never got around to it—or perhaps the later, revised version was lost (e.g., noting the parallel between *SE* 2 and *Topics* I 1, one could easily imagine the insertion of a discussion of peirastic arguments in the latter). If Aristotle is referring to the *Topics* when he says that dialectical arguments have been discussed *en allois*, it is hard to square this with the suggestion made by many commentators that the *SE* should be regarded as the last book of the *Topics*. The final chapter of the *SE*, especially 183a27-b16, indicates an intention to unify this work with the *Topics*, but the two treatises as we have them do not seem to represent the fulfillment of that intention; see Brunschwig's judicious remarks in *Topiques*, XIX-XX.

(19) "Didactic arguments" reason from the principles appropriate to each subject, and not from the opinions held by the answerer" (165b1-2); why does Aristotle add the second, negative clause? (He does not do this in the case of any of the other three types of arguments.) He must think that a special warning is appropriate here: some might believe that didactic (*didaskalikoi*) arguments reason from opinions held by the student, but this is a mistake. In *Topics* VIII 5 Aristotle himself seems to subscribe to the view here rejected: "the learner should always grant [only] what seems to him to be the case" (159a28-29; cf. 159a4-14). In *Topics* VIII, the activity of teaching takes the form of a question and answer discussion. The teacher asks questions—and the premises he "requests" must always be true (159a29-30, 161a24-28)—while the student answers in accordance with his beliefs. In the *SE*, on the other hand, teaching does not proceed through questioning: "Thus the one who makes this claim seems to be unaware of the

believed by the answerer; what is essential is that they are plausible. Peirastic premises may or may not be plausible; what is essential is that they are believed by the answerer. Why is this essential? And what does Aristotle mean when he says that peirastic arguments are based on things that "anyone who claims to possess the knowledge is bound to know"? Several passages in later chapters give us at least a few clues.

For peirastic (*hê peirastikê*) is a type of dialectic (*dialektikê*) and has in view not the one who knows but the one pretends to know but does not.²⁰ (171b4-6).

This passage suggests that the function of peirastic is to examine those who make false claims to knowledge, presumably with the aim of showing that they do not know what they claim to know.²¹ This helps us to see why the premises of peirastic arguments must be views held by the answerer. The answerer is assumed to be someone who claims to know some subject. If the examination of this person's claim is to be effective, he must answer in accordance with his beliefs; for if he does not, the results will be inconclusive (the answerer can say that he was merely "playing along" with the questioner, and that his claim to know was not really undermined.²² So in order for peirastic to fulfill its

difference between teaching (*didaskain*) and dialectical discussion (*dialegesthai*), and that the teacher should not ask questions but make things clear himself while the other should ask questions" (171a38-b2; cf. 171b3-4, 172a15-21; also Plato, *Sophist* 217c-d). Thus there are two interesting differences between the *Topics* and the *SE* in regard to teaching: (i) the *Topics* regards teaching as proceeding through questioning while the *SE* does not; (ii) according to the *Topics*, the premises in a didactic argument must accord with beliefs of the answerer while this is explicitly denied in the *SE*. (Moraux distinguishes between "discussion qui a en vue l'instruction" and "discussion philosophique", and suggests that the passage in *Topics* VIII 5 concerns the former while the passage in *SE* 2 concerns the latter; *op. cit.*, 288, n. 2. However, the same terms are used in each case (*didaskalia*, *didaskain*), and as far as I can see there is no basis for the distinction suggested by Moraux.) Barnes argues that the two different views of didactic argument represent two stages in Aristotle's thought regarding dialectic and its relationship to science, and that the earlier view is the one that sees teaching as involving a question and answer discussion; see "Aristotle's Theory of Demonstration", in Barnes *et al.*, eds., *Articles on Aristotle*, vol. 1 (London, 1975), 81. If this is correct, *SE* 2 should be regarded as later than *Topics* VIII, and we have an additional bit of evidence in favor of the chronological scheme suggested by Maier (see above, n. 6). The passage concerning teaching and learning in VIII 5 is presumably one that would have been revised if Aristotle had carried out his intention of unifying the *Topics* and the *SE*; see preceding note.

(20) In *SE* 2, peirastic arguments are treated, not as a subspecies of dialectical arguments, but as a different kind of argument. How, then, can peirastic be a type or species of dialectic? We will come back to this problem in a moment; see below, n. 34.

(21) See Maier, *op. cit.*, II 1, 67, n. 1 (on p. 68); also Moraux, *op. cit.*, 288, n. 3, and Brunschwig, "Arguments", 35.

(22) We may recall that this tactic is employed by Callicles in the *Gorgias* (499b-c); it is not in the end an effective facesaving maneuver since the questioner can simply point out that someone who really knows his subject would have no reason to avoid giving sincere answers.

function of examining those who make false claims to knowledge, it must base its arguments on views held by the answerer.

Peirastic examination is a special type of examination of false knowledge claims. If a geometer uses his knowledge of geometry to show that someone who claims to know geometry is a fraud, this would not count for Aristotle as a peirastic examination. As the following passage in chapter 11 indicates, a peirastic examination is one in which the questioner does *not* rely on the sort of expert knowledge that the answerer claims to possess.

Dialectic is also peirastic; for peirastic (*hē peirastikē*) is not the same sort of accomplishment as geometry, but one that a person might have even if he were not in possession of knowledge. For it is possible even for one without knowledge of a subject to conduct an examination (*peiran labein*) of one who does not know, if granted points [premises?] taken not from things he knows²³ or from the proper principles but from the consequences which a man may know without knowing the art in question, but which if he does not know he is necessarily ignorant of the art. So it is clear that peirastic (*hē peirastikē*) does not consist in knowledge of any definite subject. (172a21-28).

Although parts of this passage are obscure, the main points Aristotle wants to make are sufficiently clear. First of all, he is maintaining that peirastic enables a questioner to unmask someone who pretends to be an expert even though the questioner does not possess such expert knowledge himself.²⁴ Secondly, he is suggesting that the key to the ability to do this lies in those things «one could know without knowing the art in question, but which if he does not know he is necessarily ignorant of the art». In other words, if the art in question is, e.g., geometry, the peirastic examiner will need to know some matters pertaining to geometry; if he knows nothing at all about geometry, he is not going to be able to show up someone as a fraud. If the questioner knows enough about geometry to be able to show that the order man fails to know something that any geometer would know, he will be able

(23) Or possibly: "from the things from which he knows" (i.e. the principles of the science; *ex hōn oiden*). In the immediately following lines (25-27), it is said that the peirastic examiner's argument will rest on "consequences which a man may know without knowing the art in question". Presumably the man conducting the examination will know these consequences if he is using them in his argument, and thus the premises of his argument will be drawn "from things he knows". So if *ex hōn oiden* is understood as "from things he knows", what Aristotle says here seems to be contradicted in lines 25-27, whereas if we understand the phrase to mean "from the things from which he knows" there will be no contradiction, for these things—i.e. the principles—are of course distinct from the consequences.

(24) This naturally reminds us of Socrates. In fact, virtually everything that Aristotle says about peirastic in the *SE* can be seen as reflections on Socratic practices and claims; as Brunschwig suggests ("Arguments", 35) Aristotle seems to be attempting to locate his own conception of dialectic in relation to Socrates' practice.

to accomplish his peirastic mission. According to this view, the peirastic examiner must know more about the subject, or at least more about a part of the subject, than the person he is attempting to unmask.²⁵ The kinds of things he needs to know, and to use in his arguments, are not the principles of the art or science but the things that follow from these—the "consequences" (*hepomena*).

These passages in chapter 11 give us a clearer idea of the meaning of the original characterization of peirastic arguments in chapter 2. Once we see that the aim of peirastic arguments is to examine false claims to knowledge, it becomes clear why such arguments are based on views held by the answerer, and on things "such that anyone who claims to possess the knowledge" is bound to know them.

III

It is not a coincidence that the kind of examination which Aristotle calls "peirastikē" is discussed within the framework of an analysis of sophistical arguments. After all, the most striking examples of pretenders to knowledge are the sophists. According to *SE* 1, the sophist's aim is to appear wise without actually being so. The sophist holds that it is better to appear wise without being so than to be wise without appearing so, and he claims that his special art guarantees the appearance of wisdom; even those who are wise and knowledgeable may not for instance, appear so, if, they are in a confrontation with a sophist. The appearance of wisdom is achieved through skill in verbal combat. The sophist takes on all comers in debate; he argues circles around his opponents, making them seem weak and defenseless. His favorite weapon is refutation.

The sophist is not afraid of combat with experts in various fields, for his art enables him to get the better of them on their own ground.

If, then, a refutation is a sort of deduction, an argument depending on an accident will not be a refutation. It is, however, just in this that the experts and in general those who possess knowledge (*hoi epistēmones*) are

(25) According to his statements in the *Apology*, Socrates was able to show through questioning that others did not know what they claimed to know (see, e.g., 23a). His superiority over others, his "wisdom", consisted in his greater awareness of his ignorance, not in a superior knowledge of the subjects his interlocutors claimed to know. Thus Socrates seems to be committed to the claim, in the *Apology* at least, that it is possible for a questioner to unmask someone's false claim to knowledge even though the questioner does not know any more about the subject than the person he is questioning. In the *Charmides* Plato considers a claim like this and argues against it (170a-171c); it is clear from the passage we are considering in the *SE* that Aristotle also rejects the idea that one could disprove someone else's false claim to know even if one knew no more about the subject than the pretender.

refuted by those without knowledge; for the latter use deductions depending on accidents in arguing with the knowledgeable, and these people who possess knowledge, because they are unable to draw distinctions, either say "Yes" to their questions or are thought to have said "Yes" even though they have not.²⁶ (168b4-10).

If a sophist is successful in a confrontation with an expert, he appears to show that his interlocutor does not know what he claims to know (and does in fact know). One of the sophist's ploys is thus very similar to what the peirastic examiner does: the latter actually does show that his interlocutor does not know what he claims to know. Aristotle notes the close connection between sophistry and peirastic examination in the following passage.

By a sophistical refutation or deduction I mean not only a refutation or deduction that only appears true [i.e. valid], but also a refutation or deduction which is true but only appears to be appropriate to the subject. These are arguments that refute not in accordance with the subject, showing [the answerer] to be ignorant, which was the function of peirastic. Now peirastic is a part (*meros*) of dialectic, and this may deduce a false conclusion through the ignorance of the answerer. But sophistical refutations, even though they deduce the contradictory of the answerer's thesis, do not make clear if he is ignorant; for even those who know are tripped up by these arguments. (169b20-29).

The expressions "in accordance with the subject" (*kala to pragma*) or "in accordance with the art" are quasi-technical in the *SE* and mean "in accordance with the appropriate principles of the art or science".²⁷ We might call deductions or refutations fitting this description genuinely "scientific". According to the first part of the passage, not all sophistical refutations are fallacious; some are perfectly valid refutations, but are nevertheless sophistical in that they put up a false appearance of being scientific. So sophistical refutations are of two kinds, fallacious and (valid but) pseudo-scientific.

It is pretty clear in this passage that Aristotle is envisioning an encounter between a sophist and someone with knowledge ("for even those who know are tripped up by these [sophistical] arguments"); in such cases the sophist will try to refute his interlocutor with a pseudo-scientific argument, thus making it appear that he is wiser and that the other man does not know what he claims to know. Aristotle points out that showing the ignorance of those who make a false pretence of knowledge is the proper business of peirastic. A peirastic argument "may deduce a false conclusion through the ignorance of the

(26) It is clear that "those without knowledge" who refute the knowledgeable are the sophists, for one of the standard ploys of the sophist is deduction depending on accidents; see *SE* 5, 166b28-36.

(27) See esp. 170a31-34; also 171b11-12, 16-22.

answerer". In other words, the false conclusion of the peirastic argument is reached only because of the ignorance of the answerer, and thus makes clear that ignorance. The sophistical refutation, on the other hand, reaches its conclusion ("the contradictory of the answerer's thesis") not through any ignorance of the subject matter on the part of the answerer but through a deduction which is inappropriate to the subject matter.²⁸

A peirastic argument is thus the counterpart of a particular kind of a sophistical refutation—the kind designed to make it appear that someone who has knowledge is ignorant. Peirastic arguments are designed to show the ignorance of someone who merely pretends to have knowledge. Since the sophist is one who aims at the appearance but not the reality of knowledge, peirastic is a technique to be used first and foremost against the sophist. Thus it seems appropriate that peirastic examination should be discussed within the framework of an analysis of sophistical arguments.

Aristotle believes that a skillful dialectician should be able to hold his own in a confrontation with a sophist. A practitioner of dialectic must have the same skill and knowledge that the sophist has.²⁹ Of course, he will not use fallacious arguments in a dialectical discussion. But in order to avoid such arguments, and in order to be able to detect unintentional fallacies in the arguments of his interlocutor, he must understand all of the various ways in which arguments can be fallacious. For without dialectical skill we can fall prey in our own arguments to the very same fallacies that the sophist knowingly perpetrates.³⁰

A skillful dialectician will be able to hold his own against a sophist both as answerer and as questioner.³¹ If the sophist attempts to refute a thesis maintained by the dialectician, the dialectician will be able to block any sophistical deduction by pointing out the fallacy involved. (He will be like the subject who ruins a magic show by explaining to the audience how the magician's trick is performed.³²) On the other hand if the sophist challenges one to question him and attempt

(28) Others besides sophists are guilty of offering arguments which, though valid, are inappropriate to the subject matter. A favorite example is Bryson's method of squaring the circle; cf. *SE* 171b12-18, 172a2-7, *Post. Analytics* 75b37-76a3. Plato is sometimes charged with this failing; cf. *Gen. and Corr.* 316a11-15.

(29) See *SE* 170b8-11, 172b5-8. In the *Rhet.* Aristotle says that sophistry and dialectic are the same power or capacity: 1355b15-21; cf. *Metaph.* 1004b17-26, *SE* 165a24-31.

(30) See, e.g., *SE* 175a5-12.

(31) Aristotle advises dialecticians to avoid confrontations with sophists; cf. *Top.* 164b8-12 with 159a30-32. Presumably this is why he does not mention the ability to deal with sophists as one of the ways in which dialectic is useful.

(32) Socrates has this deflationary role in the *Eulhydemos*.

to show that he does not know something,³³ the dialectician will be able to do just that. He will do it in the way we have seen, using the technique of peirastic examination.

Just as an "extra-mural" discussion in which peirastic examination is used is quite different from an intra-mural dialectical discussion, so also peirastic arguments are quite different from those used in dialectical discussions. But peirastic is not an art or skill in its own right; it is rather a particular application or use of the skill of dialectic.³⁴ This view of the relationship between peirastic and dialectic seems to be borne out in the following passage from *SE* 11.

So then clearly peirastic is not a knowledge or science of any definite subject; and thus it is concerned with everything, for all the arts make use of certain common things as well. Hence everybody, including laymen, makes use in some way of dialectic and peirastic; for all to some extent undertake to test those who profess to know things. What serves them here is the common things (*ta koina*),³⁵ for they know these themselves just

(33) See, e.g., *Hipp. Major* 287a-b.

(34) We are now in a position to suggest a solution to the puzzle mentioned earlier (see n. 20 above): How can peirastic be a type or species of dialectic if peirastic arguments are not a type or species of dialectical arguments? Consider the relationship between sophistry and dialectic. If it is true that these two names refer to the same skill or capacity (see above, n. 29), then when a sophist skillfully formulates sophistical arguments, he is using the skill or *technê* of dialectic. Of course, sophistical arguments are not a type or species of dialectical arguments (see *Top.* 100a29-101a4, *SE* 165b3-8); it is rather that the skill of dialectic is such that it can be used to formulate not only dialectical arguments, but also other, very different, sorts of arguments. Similarly, peirastic arguments are quite different from dialectical, but the same skill, dialectic, is involved in the discovery and formulation of both. Moraux also seems to view peirastic as a particular way of using dialectic, and he suggests that Aristotle has peirastic in mind when he speaks of the usefulness of dialectic "for purposes of casual encounters" (*pros de las enteuxeis*; 101a30-34; *op. cit.*, 290, n. 3. Certainly one kind of "extra-mural" encounter a dialectician might have is with a false claimant to knowledge, in which case a peirastic examination might be the appropriate response. But Aristotle does not seem to have anything quite so specific in mind in *I* 2, and he speaks not of refuting but of persuading—of bringing the interlocutor over to our view (see the parallel use of *metabibazein* in 161a29-36; cf. *Rhel.* 1355a24-39, and *Eud. Ethics* 1216b26-30). Bolton (214) infers from the fact that peirastic is a "part" of dialectic that peirastic arguments must be dialectical arguments, and hence must "employ *endoxa* as premises". It should be clear, in the light of what has been said above, why I think this inference is questionable; the natural reading of *SE* 2 conflicts with the view that peirastic premises are a type of dialectical premises, and we are not compelled to view them as such by Aristotle's reference to peirastic as a part of dialectic.

(35) "What serves them here is the *koina*" translates *taula d' esti la koina*. As Brandis suggests, something like *hois chrônai hoi idiolai* must be supplied after *taula*. Bolton (215) translates *II*. 31-32 as: "For everyone attempts to test those who profess knowledge on a limited basis, and this basis is the common things". The usual translation of *mechri linos* is "to some extent", or something similar (cf. *Rhel.* 1354a3-6); it is not clear to me that the Greek words can bear the sense Bolton gives them (i.e. "on some basis"). Bolton's translation is slightly tendentious in that it could be taken to suggest that the premises of peirastic arguments consist of the *koina*. The passage implies that peirastic arguments rely on the *koina*, but it does not necessarily imply that the *koina* are the premises of such arguments.

as well as the scientist, even if what they say seems wide of the mark. Thus they all practice refutation; for they engage unskillfully in the activity that dialectic performs skillfully, and he who examines by means of the art of deduction is the dialectician. (172a27-36).

When we "undertake to test" or examine those who profess to have knowledge, we make use of dialectic; and the person who examines—who is *peiraslikos*—by means of the art of deduction is the dialectician. Peirastic is evidently being viewed as a particular use or application of the skill of dialectic.

It is characteristic of dialectical arguments in general, and of peirastic in particular, that they do not involve any scientific knowledge but rely instead on certain "common things". What are these elusive "common things"? I believe Bolton is right in maintaining that they cannot be universal principles of demonstration.³⁶ Are the *koina* then, as Bolton maintains, things that everyone not only believes but knows to be true? Let us first note that reliance on *koina* is not a special feature of peirastic; in several passages in the *SE* we are told that it is characteristic of the dialectician to rely on *koina*, and the art of rhetoric apparently shares this feature with dialectic.³⁷ If to rely on *koina* means to make use of premises commonly known to be true, the implication (clearly unacceptable) of these passages would be that all dialectical and rhetorical arguments are based on true premises. A closer look at Aristotle's use of the term will make it clear that it does not mean "things commonly known to be true".

Aristotle sometimes uses *koina* to designate generally held opinions. Consider, for example, the following passage in *Rhel.* *I* 1.

Moreover, in relation to some [interlocutors], even if we have the most exact knowledge, it will not be easy to persuade on the basis of that knowledge. For argument based on knowledge implies instruction, and this is impossible (i.e. in relation to some people); it is necessary to make use of the *koina* in framing our arguments and producing conviction, as we pointed out in the *Topics* in connection with everyday encounters with the general public. (1355a24-29).

The passage referred to in the *Topics* mentions that if we become familiar with generally held opinions, we will be in a better position to persuade the man in the street by appealing to his own convictions

(36) Pp. 215-216. As Bolton points out, the reference to Zeno's argument concerning motion as "common" in relation to medical questions at *SE* 11, 172a8-9 is a clear indication that the "common things" in this context at least include more than the universal principles of demonstration. As far as I can see, *ta koina* is never used in the *SE*, as it is in the *Post. Analytics*, to pick out the special class of principles of demonstration, such as the law of excluded middle, that underlie demonstrations in the various sciences; cf. *A Po* 88a36-b1.

(37) Cf. *SE* 170a34-36 with b8-11; see also 171b6-7, 172a29-31, *Rhel.* 1358a10-17, 1354a1-3.

(101a30-33). Hence to make use of the *koina* is to make use of generally held opinions. (Cf. Bolton, 46-7; but the generally held opinions referred to in *Topics* I 2 are clearly not "things commonly known to be true".)

There are other passages, however, in the *SE* and the *Rhetoric*, where the term *koina* designates common "*lopoi*": i.e. inference patterns or premises common to several sciences or disciplines.³⁸ Consider the following passage from *SE* 9:

Clearly, then, it is not of all refutations, but only of those that depend upon dialectic that we need to grasp the *lopoi*; for these are common (*koinoi*) to every art and faculty. ...Accordingly it is clear that it belongs to the dialectician to be able to grasp on how many considerations depends the formation, through the *koina*, of real or apparent refutations.³⁹

The fact that dialectical (or peirastic) arguments are said to make use of common *lopoi* gives us no reason to suppose that the premises of such arguments must be true. An example of a common *lopos* is "the more and the less".⁴⁰ Under the rubric of this rule or inference pattern, Aristotle suggests a number of strategies for arguing that one thing is more or less F than another.⁴¹ These strategies can be used in widely different domains, e.g. in discussions of physical as well as ethical

(38) An example of a *lopos* in discussions of comparative value would be "the most conspicuous good is more desirable than the less conspicuous, and the more difficult to attain than the easier" (117b2-29; cf. *allos* in 117b28 with *allos lopos* in 117b10). A *lopos* could be viewed as a rule that guides the formulation of an argument without actually appearing as a premise in it; but there is no reason why a *lopos* like the one cited could not be used explicitly as a premise in an argument. Sometimes Aristotle speaks of *lopoi* as premises of dialectical or rhetorical arguments; *Rhet.* 1358a2-32. An important part of Aristotle's conception of a *lopos* is that it is a matrix from which one can generate arguments appropriate for different circumstances (119a1-14; cf. 105b3-37, 163b3-164a11, 164b1-19); a mastery of the *lopoi* will enable one to discover the premises one needs in a given discussion, and this is the mark of a skilled dialectician (164b3). Aristotle's predecessors had their students memorize question and answer debates; in so doing, they were imparting the products of the art but not the art itself (*SE* 183b3-184a8). Perhaps more than anything else, it is the notion of a *lopos* as a sort of matrix of arguments that distinguishes Aristotle's teaching from that of his predecessors. (It is interesting to note that one meaning of *lopos* is the female genitalia: see L. S. J., *lopos*, I 3. But Aristotle may have been influenced more by the way the term was used in contemporary discussions of mnemonic techniques; see *Top.* 163b23-33.)

(39) 170a34-36 and b8-10; cf. 171b6-7, 172a29-31, *Rhet.* 1358a10-17. Bolton (n. 30) recognizes that *koina* is used in this sense in the *Rhetoric*, but thinks it is not used in this sense in *SE* 11. But in the passage we have just quoted from *SE* 9 it is clear that the term does not designate generally held opinions; the use of *koina* here is clearly parallel to the use of the term in *Rhet.* 1358a10-17. Furthermore, the parallel between 170a34-36 and 172a29-30 indicates that the term is used in the same sense in the relevant passages in *SE* 11. *Koina* seems to be used only once in the *Topics* (164a8), and there it seems to be a synonym of "universal" (*katholou*).

(40) See *Rhet.* 1358a10-17 and *Topics* III, *passim*.

(41) These particular strategies are also called *lopoi*; cf. 117b10ff.

questions; this is why the *lopos* of the more and the less is "common". These strategies may be used not only in dialectic but in the sciences as well; when they are used in dialectical arguments, the premises may be true but they need not be: the essential requirement is that they be plausible.⁴²

The common *lopoi* are "common" in yet another sense in that they are employed not only by trained dialecticians, rhetoricians and scientists, but also by ordinary people with no training in these fields. This is why Aristotle says that laymen "know these things", i.e. the common *lopoi*, no less than trained experts.⁴³ He is not saying that the arguments of laymen are based on premises known to be true, but that laymen—no less than experts—know about and make use of certain common strategies of argumentation.

Reliance on *koina* is a feature shared by peirastic, dialectical and rhetorical arguments, as well as by arguments of untrained laymen. We have seen that there is no basis for viewing the premises of peirastic arguments as truths that are matters of common knowledge and belief. The fact that peirastic arguments make use of certain *koina*, i.e. certain *lopoi*, does not imply that their premises must be true, or even that they must be *endoxa*. They may be *endoxa*, but they need not be. What is essential is that they be beliefs held by the answerer, for only if this is the case can there be a genuine test of the answerer's claim to know.⁴⁴

(42) See, e.g., III 6, esp. 119a38-b1, 119b15-16.

(43) *SE* 172a32-34; cf. *Rhet.* 1354a1-6.

(44) See above, pp. 273-4. *SE* 183a37-b1 ("Our aim was to discover a faculty of reasoning about any question put before us on the basis of the most plausible views available. For this is the function of dialectic in the strict sense (*kath' hautên*) and of peirastic.") seems to imply that the premises of peirastic as well as dialectical arguments must be *endoxa* (see Bolton, 200). But we should note, in the first place, that the activity referred to at 183a37-38 is not the whole function (*ergon*) of dialectic; he refers only to the activity (or ability) of the dialectical questioner, and then in 183b3-6 he mentions the others task of "upholding a thesis", i.e. playing the part of answerer in a dialectical discussion. The fact that Aristotle says that the first activity is the function of "dialectic *kath' hautên*" seems to indicate that it is the ability to question that is most characteristic of the dialectician. Is Aristotle saying (as Bolton apparently thinks) that it is the function of peirastic and of dialectic in the strict sense to argue as questioner from what is most plausible, while it is the function of dialectic in a looser sense—and not the function of peirastic—to uphold a position as answerer? The problem with this is that it is difficult to see how peirastic understood in this way fits with what is said about peirastic earlier in the *SE*; here "peirastic" seems to designate the general ability of a dialectician to conduct a test (*peiran labein*, 183b2-3) through questioning, whereas earlier the term was used for the special ability to unmask false knowledge claims.

It is worth noting that in ms. D the article *lês* before *peirastikês* (in 183a39-b1) is missing, so that *peirastikês* functions as an adjective modifying *dialektikês*. Now there are other instances where *peirastikê* is used as an adjective modifying dialectic; cf. *Metaph.* 1004b2-26, *SE* 171b9. What is it for dialectic to be "peirastic"? 183b2-3 gives us a clue:

The aim of peirastic arguments, as we have seen, is to unmask false claims to knowledge. Such arguments do not rely exclusively on *endoxa*, and are therefore not a subspecies of dialectical arguments. Peirastic arguments are related to dialectic in that the ability to conduct a peirastic examination is part of the dialectician's art. We have noted that it is also by virtue of dialectical skill that one is able to argue sophistically: the dialectician could, if he chose to, perform very effectively as a sophist; and the sophist, if he chose to, could hold his own in a dialectical discussion. Peirastic and sophistic are two different ways of exercising dialectical skill—one perfectly acceptable, the other not acceptable.⁴⁵

In his scattered remarks concerning peirastic examination, Aristotle seems to be thinking of Socrates' method of testing knowledge claims and trying to locate this method in relation to his own conceptions of dialectic and sophistic. We have noticed several indications that he is not thinking of peirastic as a form of dialectic that might be useful in a scientific or philosophical investigation; the premises of peirastic arguments need not be true, nor do they need to be plausible. The upshot is that neither in the *Topics* nor in the *SE* does Aristotle envision a kind or method of dialectic that would have some essential role in the sciences or in philosophy.

insofar as dialectic is able to "conduct a test" (*peiran labein*), it is *peirastikê*. In other words, describing dialectic as *peirastikê* is a way of focusing on the function of conducting a "test" (*peira*) through questioning. If we adopt the reading of D, we no longer have a problem reconciling 183a37-b1 with earlier passages concerning *peirastic*. This passage does not say anything about peirastic understood as the ability to unmask false claims to knowledge. Aristotle is simply referring to the two roles of the dialectician, questioning and answering or "conducting and submitting to a test", and he assigns priority to the first. Another reason against taking 183b2-3 as referring to peirastic examination is the general context. 183a37-b13 is a résumé of the subjects discussed in the *Topics*; it is only at b13-15 (cf. 183a27-36) that he mentions the contents of the *SE*. (Cf. Brunschwig, *Topiques*, XIX, n. 5). Since the *Topics* contains no discussion of peirastic examination and no use of the expression *peiran labein* to refer to such an examination, it would be out of place to allude to this type of activity in a summary of the contents of the *Topics*. If it is possible to understand *peiran labein* in 183b2-3 as referring to an activity discussed in the *Topics*, and also to understand *peirastikê* in b1 in a similar way, clearly this would be preferable in view of the general context. And if the passage is understood in this way, there is no implication that the premises of peirastic arguments (as defined in *SE* 2) must be *endoxa*. Of course, if peirastic premises express beliefs held by the answerer, they must be *endoxa* in the minimal sense that they are plausible to him; cf. *Top.* 159a38-b4, 159b2-27. But it was not *endoxa* of this sort that were originally said to be the premises of dialectical arguments (*Top.* 100a29-b23, I 10).

(45) Perhaps this explains why peirastic is said to be a "part" of dialectic whereas sophistic is not; when a dialectician conducts a peirastic examination he is still acting *qua* dialectician, but when he meets the sophist on his own ground he is not.

IV

The position we have argued for thus far seems to fly in the face of Aristotle's explicit statements about the usefulness of dialectic in relation to philosophy in *Topics* I 2. Particularly troublesome for our interpretation is his claim that the first principles of the sciences must be treated on the basis of *endoxa*, and that this is the proper task of dialectic. Does this not imply that dialectic has an indispensable role in the sciences in regard to the discovery and establishment of first principles?

In spite of the strong attraction of such a view, I do not think we should take Aristotle's statement about dialectic and first principles as an indication that one of the aims of his treatise is to formulate a method to be used for the discovery or "validation" (Bolton) of the first principles of the sciences. In the first place, as we have seen, there is no trace of such a method in the *Topics* or *SE*. Secondly, and more importantly, in a number of passages we find a sharp distinction between the activity of the dialectician *qua* dialectician and the activity of the philosopher. When we are engaged in a dialectical inquiry or discussion, we are not doing philosophy, and vice versa.⁴⁶ Hence the philosophical utility of dialectic must be understood in some way other than through its providing a method to be used in a philosophical inquiry.

It might be useful to consider the relationship between dialectic and sophistic. The activities of the sophist and dialectician *qua* dialectician are very different: someone engaged in a sophistical debate is not carrying on a dialectical discussion or inquiry, and vice versa. Nevertheless, the sophist *uses* dialectic in the sense that the skill he employs is the same as that of the dialectician; there is not a separate skill of *sophistic* corresponding to sophistical arguments.⁴⁷ So training in dialectic is useful to the aspiring sophist, not by providing a special

(46) See, e.g., 155b7-16, 105b30-31; cf. 162b31-33, *SE* 175a31-33. According to 155b10, a distinctive feature of dialectical discussion is that it is conducted "in relation to another" (*pros heteron*). However, at 163a36-b4 Aristotle says that we can practice dialectical argumentation by ourselves, and this is sometimes cited as evidence that it is not an essential feature of dialectic that it involve a discussion between two people (a philosopher working by himself can be arguing dialectically). But the sort of practice Aristotle is thinking of at 163a36-b4 would still be done "in relation to another": we would simply imagine ourselves in first the role of questioner and then the role of answerer; the distinction between dialectical and philosophical argument noted in 155b7-16 would apply no less to such solitary dialectical discussions.

(47) See above, n. 29.

method, but by giving a skill in formulating and analyzing arguments which is transferrable to sophistical debates.

Dialectical skill is thus useful in non-dialectical as well as dialectical contexts.⁴⁸ In the initial stages of a philosophical inquiry (a non-dialectical context), Aristotle believes it is useful to "problematize" (*diaporeô*)—to formulate arguments on both sides of various controversial issues. These arguments will not normally be dialectical, but the ability to formulate them is a matter of dialectical skill.⁴⁹ This is the first of the two ways in which dialectic is said to be useful to philosophy in *Topics* I 2.

The second way in which dialectic may be of use to philosophy is described in the following passage.

It has a further use in relation to the principles used in the several sciences. For it is impossible to discuss them at all from the principles proper to the particular science in hand, seeing that the principles are primitive in relation to everything else: it is through the *endoxa* about them that these must be treated, and this task belongs properly, or most appropriately, to dialectic; for insofar as it tests, it provides a way (*hodos*) to the principles of all inquiries.

This passage clearly seems to imply that it belongs to dialectic to discuss the first principles of all branches of knowledge on the basis of *endoxa*. But let us note, first of all, that the passage is doubly anomalous. As Brunschwig has pointed out, it seems to fall outside the classification of ways in which dialectic is useful which we find at the beginning of chapter 2.⁵⁰ More importantly, there is no reference to this very important task of dialectic anywhere else in the *Topics*—or indeed anywhere else in Aristotle's works. There are well known passages about how we come to know first principles; there are even references to "the way" (*hodos*) to the first principles of the sciences.⁵¹ But in none of these contexts is there any mention of dialectic or of the need to discuss principles on the basis of *endoxa*.

The claim that it is necessary (*anangke*) to discuss first principles on

(48) One example of such a non-dialectical context is the day to day encounters (*entelezeis*) that are mentioned at 101a30-34; cf. *Rhet.* 1355a21-29. Insofar as rhetoric depends on dialectical skill (cf. 1356a25-27, 1359b9-12), speaking in the public assembly would be another non-dialectical context in which dialectical skill might be exercised.

(49) In *Melaph.* B, for example, there is no indication that the various arguments formulated *pro* and *con* rest exclusively on *endoxa*. (Note that at 995b20-25 Aristotle seems to imply that what the dialecticians do is different from what he is doing.)

(50) See *Topiques*, 116-7. It might be argued, against Brunschwig, that what Aristotle means by *tas kala philosophian epistêmas* in 101a34 is not a subclass of *hapasôn lôn methodôn* in 101b3. But does Aristotle believe that raising difficulties on both sides of an issue is useful in all areas — e.g., in mathematics? At *A Pr* 46a3-4 Aristotle distinguishes between philosophical and other types of inquiries.

(51) See, e.g., *A Pr.* 43a20-22, 46a3-27, *A Po.* 84b19-31, II 19.

the basis of *endoxa* also seems to conflict with Aristotle's view in the *Post. Analytics*. According to II 8-10, we come to know some definitions, e.g., the definition of lunar eclipses, through scientific inquiry. We discover that an eclipse of the moon is caused by the earth's blocking the sun's light, and this is then incorporated in our account of what an eclipse is. A definition of this sort would presumably count as a principle;⁵² and it is clear that the way we arrive at it is not through dialectical discussion. Aristotle's understanding of how first principles in the sciences are arrived at in the *Analytics* seems incompatible with the sweeping claim about dialectic in our passage in *Top.* I 2. Arguments based on *endoxa* would seem more appropriate in areas where empirical investigation is of little or no help in the discovery of first principles, e.g., in first philosophy or ethics. But the claim in I 2 applies to *all* branches of knowledge, and in any case it is difficult to see how dialectical discussion, as described in *Topics* VIII, could provide a way to the discovery of true first principles.

In view of the fact that Aristotle's sweeping claim about dialectic seems to be anomalous in its context, we might consider the possibility that it is a vestige of an earlier, more "Platonic", version of the *Topics*.⁵³ In Book VII we find the suggestion that it is possible, though very difficult, to "establish" (*kalaskeuazein*) definitions through dialectical arguments.⁵⁴ Throughout the central books of the *Topics* (II-III) Aristotle speaks of "establishing" or "destroying" such claims as that X is the genus of Y, or that X is "proper" (*idion*) to Y. He may mean "establishing" or "destroying" according to opinion only (*kala doxan*), so that even though one has "established" that X is the genus of Y, in truth it might not be. However, as Moraux suggests,⁵⁵ one gets the impression in these passages that Aristotle means something stronger. Nowhere in II-VII do we find the contrast between arguing *kala doxan* and *kal' alêtheian*, and when Aristotle speaks of establishing some claim he does not give any explicit indication that "establish"

(52) See, e.g., 158a31-b4, 158b24-159a1.

(53) How would the "vestige" find its way into the later version? We might imagine that a later editor had two texts of this part of the treatise: one an earlier, the other a revised version; wherever the earlier version had something that seemed important to the editor, but was lacking in the later version, he would insert it into the latter. An editor of Aristotle's works would naturally be reluctant to discard anything written by the master.

(54) See VII 3 and 5. Aristotle does not claim that one can "demonstrate" a definition, but only that one can "syllogize" or *deduce* a definition; thus there seems to be no explicit contradiction between these chapters and *A Po* II 3-7.

(55) *Op. cit.*, 307-8. I would not agree with Moraux's suggestion that dialectical arguments in II-VII are not understood as arguments resting on *endoxa*; it is rather that Aristotle believes at this point that arguments resting on *endoxa* may yield conclusions that are true and well founded. Cf. *Rhet.* 1355a14-15.

must be understood in a qualified sense. If he believed, at the time of writing Book VII, that one could establish through dialectic that a certain formula expresses the true definition of something, and that definitions are principles of the various sciences,⁵⁶ then of course it would not be surprising to find him making the sweeping claim about dialectic that we find in I 2.⁵⁷

Whether or not one finds this hypothesis plausible, the fact remains that 101a36-b4 has no echo elsewhere in Aristotle's works, and actually seems to conflict with a number of passages that discuss the "way" to first principles. It would be imprudent to suppose, on the basis of this single passage, that Aristotle's mature conception of scientific and philosophical inquiry assigns an important role to dialectic.

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I will conclude with a few caveats. My brief remarks concerning the question of the philosophic utility of dialectic obviously do not settle things one way or the other; at best, they will raise doubts about whether Aristotle's claim at 101a36-b4 reflects his mature view of the relationship between dialectic and philosophy. My chief aim in the essay was to show that there is no evidence in the *Topics* and *SE* for a special form of dialectic to be used in philosophical or scientific investigations; it is possible that the remarks about the usefulness of dialectic in *Topics* I 2 have in view a special dialectical method which is described in another work.⁵⁸ I must content myself with having shown that there is no sign of such a method in Aristotle's treatise on dialectic.

(56) The *Topics* does not mention any other kinds of principles besides definitions.

(57) It is in its capacity as *exelastikê* that it provides a way to first principles, so perhaps we should understand the procedure of establishing a definition as including showing that other proposed definitions are unsatisfactory.

(58) For example, it is often claimed that the method described in *Nicomachean Ethics* VII 1 is the method of dialectic. But Aristotle does not use the term "dialectic" in discussing that method, and as far as I can see there is no connection between it and what is described as dialectic in the *Topics* and *SE*.

SCIENTIFIC EXPLANATION AND EMPIRICAL DATA IN ARISTOTLE'S *METEOROLOGY*¹

CYNTHIA A. FREELAND

INTRODUCTION

In this paper I intend to examine certain significant aspects of Aristotle's scientific practice as recorded in his *Meteorology*.² I will survey a number of examples in order to study the complex relations between scientific theory and empirical data in this treatise. Aristotle advances definitions of a host of meteorological phenomena; these definitions, very broadly considered, conform to the model recommended in the *Posterior Analytics*.³ That is, individual meteorological subjects such as comets or thunder are defined in terms of a causal analysis resting upon a unified set of underlying principles. The first

(1) An earlier version of this paper was presented to Robert Bolton's seminar on Aristotle's philosophy of science at Rutgers University in March, 1987. I am grateful to the participants in the seminar, and in particular to Tim Maudlin, for questions and comments. In general I am much indebted to Bolton for his comments on these topics in numerous conversations over the past several years. I also hope that the paper has been improved by incorporating responses to questions raised when the earlier version was delivered in La Rochelle.

(2) In fact I will only discuss Books I-III of the *Meteorology*. This is due less to concerns about the authenticity of Book IV than to its fairly obvious lack of continuity with the earlier books in terms of approach and methods. The absence in Book IV of the fundamental *archai*, the exhalations, consistently used throughout I-III, makes Book IV seem part of a different project (although it covers subject-matter we would expect to be included on the basis of the treatise's overall program). See also my discussion in Freeland (1986).

(3) See *Post. An.* II, 10 and for an interpretation of this model of "real definitions" see Bolton (1976).

principles of this science are set forth in Book I, 3; they are two fundamental exhalations, one hot and dry, one cool and moist. I will not here pursue important questions concerning these first-principles — in particular whether this treatise employs the deductive explanatory structure recommended in the *Posterior Analytics*.⁴ Instead, my focus will be on certain steps recorded in this treatise which are not mentioned in Aristotle's model of pure science — steps which precede and follow upon his core explanations (definitions) of meteorological phenomena.

In Part I, I will explore the role of the *endoxa*, the reputable opinions or earlier scientific beliefs which Aristotle surveys before providing his own accounts of various phenomena in this science. The proper assessment of Aristotle's use of *endoxa* in science is a topic of much current interest and debate.⁵ I believe that the surveys of *endoxa* play a dual role in this work, enabling Aristotle to refine why-questions and to gather relevant empirical data or *phainomena*. The extent of their role cannot be fully grasped without a correlative understanding of Aristotle's use of "signs" (*sēmeia*) and "proofs" (*tekmēria*), which are often mentioned in his arguments for the correctness of his own accounts. In Part II, I will show that Aristotle uses signs and proofs in an inference pattern now termed "abduction", to argue from explanatory success to the truth of his proposed analyses. In my concluding Part III, I will address another topic that has been of recent interest, whether Aristotle means his account of scientific knowledge in the *Posterior Analytics* to serve as a model for the cognitive state of a scientist prepared to provide explanations, the best structure for organizing and imparting scientific knowledge, or a recreation of the processes of real scientific inquiry.⁶ I argue that in the key respects in which Aristotle's practice in the *Meteorology* differs from the proposed model of the *Posterior Analytics*, he adds more than mere rhetorical supplements to the ideal model of the latter text. Instead, he reveals a concern for what contemporary philosophers of science call the "pragmatics of explanation."

(4) I do this in a companion piece, Freeland (1986). Of course, separating these questions from the subjects of this article will result in some regrettable artificiality of analysis.

(5) See Barnes (1980), Bolton (1987), Brunschwig (1987), Cooper (1988), Devereux (1987), Kakkuri-Knuuttila (1987) and (1988), Nussbaum (1982) and (1986), and Owen (1961).

(6) On these debates, see in particular Burnyeat (1981) and Barnes (1975).

Part I. The Role of *Endoxa* within the *Meteorology*

A. OVERVIEW

As defined in the *Topics*, the *endoxa* include "what seems so to all or the majority or the wise" (100b21-4). Aristotle provides no special rationale in the *Meteorology* for his frequent surveys of predecessors' views, unless we are to count his remark at 339b28-30:

We maintain that the same opinions recur among men in rotation, not once or twice or occasionally, but infinitely often.⁷

In general in his surveys Aristotle studies only the opinions of the wise — Anaxagoras, Heraclitus, Empedocles, the Pythagoreans, Democritus, Hesiod, Hippocrates of Chios, Anaximenes, Cleidemus, and Plato. In no case does he treat any of these men as having offered a unified and comprehensive theory of the meteorological realm, a full rival to his own. Instead, in the course of laying out his own remarkably unified theory, he proceeds *via* an apparently random series of attacks on various aspects of his predecessors' accounts. In just one instance does Aristotle seem impressed by an earlier view — an account of rivers and winds is termed "ingenious" (*kompseuma*) at I, 13, 349a28-31. More typically, his predecessors are quickly, even derisively, dismissed. Thus Aristotle complains that previous accounts of the winds might have been proposed by (in Lee's translation) "the man on the street." Democritus' explanation of why the sea is salty is compared to one of Aesop's fables (II, 3), and Empedocles' account of the same phenomenon is relegated, as metaphorical, to the realm of poetry. Again on the topic of winds Aristotle criticizes an earlier view, saying, "The unscientific views of ordinary people are preferable to scientific theories of this sort" (I, 13, 349a27-8). He often claims not only that previous theories are false but that they are "silly" or "absurd."

B. DIALECTICAL SURVEYS OF *ENDOXA*

Aristotle also dismisses proposals by saying that they lead to "impossibilities" (*adunata*). The implications of this charge fluctuate. Occasionally he says that the proposed explanation can be demonstrated to be inadequate by the use of reason alone. Thus, for

(7) The Greek text cited throughout is that of the Loeb edition (Cambridge, Massachusetts: Harvard University Press, 1982), and the translations are those of the Loeb translator, H. D. P. Lee, with occasional modifications.

example, he criticizes Democritus' view that comets are (appearances resulting from) conjunctions of planets by arguing that stars (here including planets) appear as individual points; but the appearance of the conjunction of two individual points would *itself* be an individual point, not a comet or something with any greater magnitude. Aristotle says then that this theory fails on the basis of logic or reasoning (*ek lou logou*).⁸

There are other similar instances in which Aristotle rejects a proposal by a relatively simple process of reasoning about its consequences. Thus for example in I, 13, he considers what must be the case if we accept the theory that rivers originate from the collection of rain within a reservoir deep inside the earth:

...It is evident (*phaneron*) that if anyone tries to compute the volume of water constantly flowing each day and then to visualize a reservoir for it, he will see that to contain the whole yearly flow of water it will have to be as large as the earth in size or at any rate not much smaller. (349b16-19)

Again, he argues in II, 1 against the *endoxon* that the sea has sources, as follows:

...[I have given] a complete enumeration of the various species of water: and from this classification one can see that it is impossible (*adunaton*) for the sea to have sources. For water that has a source is either running or artificial: but the sea has neither of these characteristics... And we know of no volume of water of comparable size that has sources and yet stands of its own accord. (353b30-35 *passim*)

Later, in II, 9, Aristotle challenges Empedocles' and Anaxagoras' view that thunder and lightning result when fire is trapped in clouds by noting,

...There must be a separate and distinct cause of the occurrence of each phenomenon, whether thunder or lightning or anything else. But the cause proposed is far from fulfilling this requirement. It is rather as if one supposed that water and snow and hail emerged ready-made, and did not have to be formed because the atmosphere has a stock ready to hand for each occasion. (369b28-34)

(8) Among points disputed in recent discussions is whether the *Topics* characterizes dialectic, a special form of logical examination of beliefs through question and response, as itself "the method of *endoxa*" or as a distinct enterprise with its own rules. Part of what is at issue involves the *Topics*' fairly rigid distinction between roles of questioner and answerer. Another issue concerns whether dialectical inquiry can "test" the *endoxa* against empirical data. See Bolton (1987), Brunschwig (1987), Devereux (1987), and Kakkuri-Knuuttila (1987). In describing two major types of treatments of the *endoxa* in the *Meteorology*, one generally "logical" and one "empirical," I am not committing myself to a particular view on these disputed issues. However, I do think that the particular way in which Aristotle tests the *endoxa* against empirical *phainomena* in this treatise is not envisaged by the *Topics*; it goes beyond even Bolton's characterization of how dialectic (in particular "peirastic") can help to supply empirically adequate explanations. See my section IC, below.

In another especially interesting instance of what might be classified as an ordinary "by-the-book" dialectical refutation of a proposed explanation,⁹ Aristotle advances a three-pronged attack in II, 2 on the Heraclitean view that the sun is fed by moisture. He argues first that if this is true, then the sun would be constantly changing, like a flame: "Clearly there would not only be, as Heraclitus says, a new sun every day, but a new sun every second" (355a13-15). Second, there is no more reason to believe that the sun is fed by moisture drawn off the earth than to think that a fire is fed by the water heated over it. And third, the Heraclitean fails to explain the reciprocity between moisture rising up and what returns to the earth; but as Aristotle says,

...We can see clearly (*phanerōs horōmen*) that the water drawn up always falls again. Even if the correspondence is not exact in any one year or any one place, yet in a certain fixed period what was taken is returned. (355a26-28)

To summarize, in these sorts of discussions of *endoxa* Aristotle reasons against an opponent on the basis of certain unquestioned assumptions (such as that stars appear as points), simple classifications (such as the account of the species of water in II, 1), or common-sense inferences (such as that the earth could not contain a hidden reservoir of water that is nearly its own size). These discussions are not especially remarkable from the point of view of standard descriptions of dialectic. But they are not typical of Aristotle's treatment of *endoxa* in this treatise. For the most part, Aristotle tends to refute the *endoxa* in this science by placing them up against certain *phainomena* or observed facts — what we might call the empirical data. Indeed, this is most frequently the method by which he presents the data which are of special concern and which an adequate scientific explanation must take into account.

C. ENDOXA AND EMPIRICAL PHAINOMENA

At times Aristotle begins by listing a few key facts about some subject, as he does concerning hail, for instance, in I, 12:

In considering the process by which hail is produced, we must take into account both facts whose interpretation is straightforward and those which appear to be inexplicable. (347b34-37)

More often, though, Aristotle launches straightaway into his examination of the *endoxa*, or at any rate of the strongest existing explanatory candidates, and he proceeds to show their inadequacies. His critique may mention some prediction the proposed account makes which turns out to be false, some fact it has overlooked,

(9) For a general outline of Aristotle's account of dialectic in the *Topics*, see Kakkuri-Knuuttila (1987).

or simply some claim it makes which does not accord with the facts as "we have observed" them. I should emphasize that Aristotle does not make use of surveys of the *endoxa* in connection with each and every topic in the *Meteorology*, but rather with those he finds most puzzling. These include, for example, comets (I, 6 and 7), hail (I, 12), the origin of winds and rivers (I, 13), the saltiness of the sea (II, 1 and 3), earthquakes (II, 7 and 8), and thunder and lightning (II, 9). I will next examine two of the most interesting of these studies, those concerning comets and hail, in more detail.

D. COMETS

Aristotle devotes all of *Meteorology* I, 6 to a discussion of previous accounts of comets, before moving ahead to give his own explanation in I, 7. Here is a sketch of each of the views he considers:

- (i) Democritus and Anaxagoras say that comets are conjunctions of planets; they appear to touch each other because of their nearness.
- (ii) Some Pythagoreans say that a comet is one of the planets which (like Mercury) appears seldom, and never far above the horizon.
- (iii) Hippocrates of Chios says that a comet's tail is an appearance caused by reflective moisture drawn along by the comet's motion. It only acquires a visible tail when seen in the north.

In essence, here are Aristotle's responses to each theory:

Against (i), (effective against (ii) and (iii) as well) :

- (a) Some of the fixed stars have tails. "And for this, we need not rely only on the evidence of the Egyptians who say they have observed it; we have observed it also ourselves. For one of the stars in the thigh of the Dog had a tail, though a dim one: if you looked hard at it the light used to become dim, but to a less intent glance it was brighter."

Against a variation of (i) which holds that a comet can result from the conjunction of a star with a planet:

- (b) In this case, stars should always appear at the dissolution of a comet, but this is not so. And furthermore, "We ourselves have observed the planet Jupiter in conjunction with one of the stars in the Twins and hiding it completely, but no comet resulted."
- (c) "On purely logical grounds" we can see that the conjunction of two stars (or of a star and a planet) which each appear as points will itself appear as a point, not as a comet [this case was reviewed just above].

Against (ii) :

- (a) The planets all fall into retrogradation within the zodiac circle, but many comets have been seen outside the circle.
- (b) More than one comet has been seen at a time.

Against (iii) :

- (a) Sometimes this planet should be seen without its tail (which has the reflective appearance), but it is not.
- (b) It's not true that comets appear only in the north, and only during the summer solstice; Aristotle cites instances of comets seen in the south and west, and in the winter solstice.

Aristotle concludes by remarking, "Though more could be said, this is enough to demonstrate the falsity of current theories of the causes of comets" (344a2-4).

Notice exactly what has occurred in Aristotle's discussion of the *endoxa* concerning comets. First, a number of empirical facts (*phainomena*) have emerged which were not included in the initial characterization (nominal definition) of comets. We have learned that, like stars, comets are bright bodies which emerge and follow certain paths through the sky; but they differ in their actual appearance — in having tails. Comets do not occupy the general region of the sky occupied by planets; nor do they occur in any fixed constellation, season, or region of the sky. They seem to appear and disappear at random, and sometimes more than one comet appears at a time. Second, Aristotle has done a great deal to focus his inquiry by raising very specific questions: Why don't comets follow the zodiac? Why do they sometimes appear with stars, sometimes not? Why are their appearances more random and infrequent than those of stars and planets? Third, having criticized earlier views for failing to answer these questions about comets, Aristotle is now under a *prima facie* obligation to propose an account which will explain the *phainomena* just noted. That is, in addition to explaining the most obvious feature of comets, their tails, Aristotle must now account for their positions and movements, generation and dissolution, relation to stars and planets, and infrequency of appearance. I will briefly sketch Aristotle's own account of comets in Section F below; but I am not really so much interested in assessing his actual explanation as in underscoring Aristotle's own efforts to argue for his theory's explanatory adequacy and superiority to its rivals. These arguments will become clearer when I review his use of signs and proofs in Part II, below.

E. HAIL

Aristotle proceeds differently in his discussion of hail; he *begins* by listing various *phainomena*, some of which he calls straightforward, others hard to explain (*paraloga*). He assumes a common understanding of the nature of hail (or of its nominal definition): "For hail is ice, and this is obvious to all" (348a33); also obvious, of course, is that hail is ice which falls from clouds. But beyond these obvious facts, Aristotle cites the following additional *sumbainonta*:

- (i) Hail is ice, yet it's commonest in spring and fall, less so in summer, and least in winter, the coldest season; similarly, it falls in milder districts.
- (ii) Hail seems to be water frozen up high in the clouds; yet this is odd, for the water has to be up there to get frozen, yet once it's frozen it can't stay suspended for very long. And hailstones can't grow in size while they're up in the clouds, since frozen drops won't coalesce as liquid ones will. (Cf. 347b36-48a14)

Next Aristotle considers a previous theory — only one is deemed worthy of note, that of Anaxagoras. Anaxagoras held that hail is formed when a cloud gets forced into a cooler region up above it, where the sun's warmth has not been reflected up from the earth. "And so hailstorms occur more often in summer and in warm districts, because the heat forces the clouds up further from the earth" (348a18-21). Notice that Anaxagoras' theory "explains" not only why hail falls and how it is formed, but why it falls *when* it does. Nevertheless, Aristotle raises problems about its explanatory adequacy (348a21-37). He notes that according to Anaxagoras it should hail more in high places — but it doesn't. Second, sometimes the biggest hail falls from clouds closest to the earth, but on Anaxagoras' view we would expect just the opposite. Finally, Aristotle observes that sometimes hail is very large but irregularly shaped, indicating it has fallen close to the earth (if they had formed higher up, the hailstones would have been rounded off by their fall); but once again, this is not what Anaxagoras' view would lead us to expect.

Here again, as in the case of comets, Aristotle introduces the *phainomena* or empirical data about hail via his critique of an *endoxon*. In addition to knowing the facts initially cited in I, 12, we now know that hail falls a lot in low lands and from clouds near the earth — indeed, this is the source of the largest hailstones. Sometimes hailstones can be very large but not rounded. Once again, Aristotle has raised quite specific questions about his subject: Why does hail occur more in the fall and spring than winter, when cold temperatures are more prevalent? Why do larger hailstones fall from clouds nearer the earth, when it would seem that if they fell further they could get larger? What accounts for large irregularly shaped hailstones? Once more Aristotle has committed himself to explaining these complex constellations of facts. He must account for the locale and seasons of hailstorms, as well as certain facts about the sizes and shapes of hailstones falling from particular types of clouds.

F. ENDOXA AND ARISTOTLE'S EXPLANATIONS

Aristotle may at the very least use the *endoxa* to supply a nominal definition at the start of an inquiry; certainly he considers it necessary to account for why there are "comets", i.e. starry objects with tails, or why there is "hail", i.e. ice which falls from the sky. But it is evident that Aristotle feels no obligation here to propose a theory that "explains" all the *endoxa* on a given subject, even those he considers mistaken.¹⁰ He

(10) This runs counter to what many see as his attitude in a methodologically important section of the *Nicomachean Ethics*. See, for example, Cooper (1988), p. 553:

would regard it as misguided to concoct some theory explaining Anaxagoras' mistakes about hail or Democritus' mistakes about comets. Aristotle at least credits his predecessors with having been engaged in the same sort of enterprise he is; so glancing back at their efforts can help his own inquiry both by raising new questions and providing new data. Surveys of *endoxa* furthermore set up expectations for explanatory adequacy. Aristotle aims to generate an account that will be more than merely consistent with the empirical facts, but one that will explain the *phainomena* concerning comets, hail, and so on, many of which have emerged as the result of his critical examination of the *endoxa*. He does not go so far as to maintain explicitly that his own scientific accounts will permit a strict derivation of *all* the *phainomena* he has recorded concerning comets, hail, etc. Nevertheless, his practice indicates that he is confident his own proposals afford greater explanatory power than their rivals, and he takes pains to point this out.¹¹

A rough overview will enable us to see whether and to what extent Aristotle's own explanations of comets and hail constitute improvements over those of his predecessors. The key components of all the scientific explanations offered in *Meteorology* I-III are the two *archai* which are basic in this science. These serve primarily as material causes of various phenomena in this realm, though they also seem at times to possess efficient-causal force. In his account of comets Aristotle begins by alluding to what he has hypothesized earlier (*hupokeilai*) concerning the hot dry exhalation. He then proceeds to explain the nature of comets by alluding to this exhalation and also to the movements of

"Why... does Aristotle make philosophy answerable even in this limited way to the *endoxa*? In his extant works he never addresses this question squarely, but the obvious answer... is that there is antecedent good reason to expect that some or all of what is reputedly believed is true... Other things being equal, intelligence when applied to a problem gets things right..." Cooper is here addressing claims made by Nussbaum (1986). See also Bolton (1987), especially Section IV, p. 35, for discussion of Aristotle's views on the relation between *endoxa* and truth. Brunschwig (1987) helpfully suggests that there may be some divergence in Aristotle's opinions on this issue as expressed in his ethical writings and his natural scientific works.

(11) Owen (1961) argues that a successful theory must leave the *phainomena* standing; to this it may be replied that Aristotle sometimes expects more of a theory — that it not merely be consistent with the *phainomena* but actually explain them. See on this Bolton (1987). There are complex issues here about whether the *phainomena* include *endoxa* or are separate, referring rather to "empirical data" more narrowly understood. I cannot go into these general issues here. See, again, Owen (1961), Bolton (1987), also Nussbaum (1982). I think it is evident in the *Meteorology* that Aristotle holds that an adequate theory must explain, and not merely be consistent with, the empirical data. But for one puzzling remark running counter to this interpretation see my Appendix II below.

bodies in the supralunary realm. The two key contributing aspects of comets are:

- (a) a fiery principle resulting from upward motion in the realm above the earth (the principle of ignition) and
- (b) a suitably condensed mass of the hot dry exhalation (the fuel).

Aristotle further remarks that the phenomena resulting from combinations of these two causal components may vary in shape. They can take either the more familiar form of a long-tailed comet or instead the shape of what "is called" a bearded star (*kaleila pōgōnias*; 344a23). This is an important passage, for it provides an example of how scientific understanding may lead us to group together two phenomena we had formerly described by different names, since they turn out to have the same essence.¹²

Aristotle uses his own account to explain the various facts about comets he set out in his earlier critique of the *endoxa*:

The reason why comets are few in number and infrequent, and why they appear more outside the tropics than within them, is that the movement of the sun and stars not only separates off the hot substance but also disintegrates it as it is forming. (345a6-9)

Since Aristotle believes that sometimes the appropriate masses of hot dry exhalation occur in the vicinity of a star, he can also account for why a comet may, but need not, occur in conjunction with a star:

When therefore the material gathers in the lower region, the comet is an independent phenomenon. But when the exhalation is formed by the movement of one of the stars — either of the planets or of the fixed stars — then one of them becomes a comet. (344a34-b1)

Comets do not necessarily appear in any particular part of the sky because the hot dry exhalation could be massed anywhere. Several comets might appear in certain rare cases in which the comet-making components occur at more than one place in the sky. And so on.

In much the same way, Aristotle's proposed explanation of hail is couched in terms of his hypothesized fundamental exhalations. He does, however, rely upon an additional complex principle (which he takes to have been endorsed previously): the basic idea is that heat and cold can "condense" one another. In other words, heat applied to something cold will, at least initially, compress the coldness inward, intensifying it. Once more, Aristotle's account of the phenomenon he is studying, hail, has formal and material aspects. In warm seasons, he explains, the heat outside a cloud can condense the coolness in that cloud when it descends into the warmer regions near the earth. Then

(12) In other words, the nominal definition of comet as "long-haired star" directs scientific attention toward a certain subject though it incorrectly indicates the essence of that subject. See Bolton (1976).

the cloud's internal moist exhalation is rapidly frozen; since this makes it heavy, it falls to the earth as hail. On this account it is possible, Aristotle believes, to explain some of the puzzling facts we initially observed about hail. For instance,

Hail is rarer in the summer than in spring or autumn, though commoner than in the winter, because in summer the air is drier; but in spring it is still moist, in autumn it is beginning to become so. (348b26-29)

Again, it hails less in high places because the air surrounding clouds is cooler there. And further, larger hailstones come from clouds closest to the earth because such clouds have been more subject to the "heat-compresses-cold" principle.

G. *ENDOXA* AND SCIENTIFIC METHOD

What conclusions can be drawn about the role of *endoxa* in science based upon examples from the *Meteorology*? It may seem simply that Aristotle gains a kind of rhetorical advantage from his method of presenting, and then summarily dismissing, his predecessors' best efforts. This, however, is too simple an assessment.

As I see it, Aristotle uses his surveys of prior theories to accomplish two related tasks. First, in those cases in which he includes such surveys, i.e. precisely when studying the most difficult, intriguing phenomena of this science, he presents the basic data or empirical facts about each phenomenon within the context of his refutation of an earlier view. What may at first seem to be merely a matter of convenience, or perhaps a rhetorical move aimed at general one-upsmanship, might instead indicate a special way in which Aristotle sees science as a sort of cumulative group endeavor. That is, he regards it as important to see where an existing scientific theory fails, because it makes a false prediction about something *that one might otherwise not have considered relevant, so might not otherwise have observed*. An account of comets as planets, for example, predicts that they should appear only within the zodiac circle; so we are made aware that location in the sky is an important feature of comets and we acquire an important directive for seeking data which go beyond the initial observations about comets' most noticeable features, their tails. Or, if a theory of hail such as Anaxagoras, indicates that larger hailstones should fall from higher clouds, then as scientific observers we are prompted to gather certain *phainomena* about hail and perhaps to notice heretofore unobserved details about what kind of hail falls from what kind of cloud, and in what location and season.

In their second key role, Aristotle's surveys of *endoxa* reflect a picture of science as a problem-solving activity. Aristotle's critical discussion of an earlier scientific explanation, such as Anaxagoras'

account of hail, does not merely direct him and his reader/listeners toward an accumulated list of data about hail, it also creates a puzzle or focuses a question about the *phainomena*. A key question about hail is not just what it is (or, in the rephrased version we might expect from certain passages of the *Posterior Analytics*, why does ice fall from the sky?), but rather, why does ice fall from the sky *less often in winter than in fall or spring*? After all, it's colder in the winter, and ice is formed by cold. Or in other words, why does hail behave differently than snow?

The complexity of the scientific inquiries in the *Meteorology* is much greater than that allowed for by the *Posterior Analytics*. Perhaps Aristotle's discussion of scientific definition in the *Posterior Analytics*, particularly in Book II, 8 and 10, is meant to be very schematic. When he asks about what thunder or eclipses are, he suggests that the scientist will look for a cause which can be incorporated into an appropriately grounded definition. For example, he suggests, thunder might be defined as the noise of fire being quenched in the clouds. This is certainly not his own account, and furthermore, in an actual scientific inquiry about thunder he will raise more specific questions, e.g.: Why does lightning only sometimes occur with thunder? Why is thunder associated with certain types of clouds? What distinguishes thunder from other loud noises in the sky? These sorts of questions arise because the inquirer has paid attention not only to the empirical *phainomena* but also to the *endoxa*.

Of course, the *Posterior Analytics* emphasizes the need for explanatory complexity when it admits that there are multiple (viz. four) possible types of causal explanation. It is helpful to juxtapose Aristotle's view of scientific explanation to more modern ones, such as that of Bas C. van Fraassen's in his book *The Scientific Image*.¹³ Like Aristotle, van Fraassen is concerned about the asymmetries of explanation.¹⁴ In partial response he reviews recent analyses of the logic of questions, including those of Belnap and others.¹⁵ Focusing particularly on why-questions, Van Fraassen suggests that they may be differentiated according to *topic*, *contrast-class*, and relations of *explanatory relevance* (pp. 141 ff). It is not necessary to go into the details of van Fraassen's exposition of these aspects of why-questions in order to recognize their usefulness for describing Aristotle's approach to the *endoxa* in the *Meteorology*. A scientific inquiry is not only launched but

(13) Van Fraassen (1980 b). In their 1988 paper Kakkuri-Knuuttila and Martin Kusch describe a general "question-theoretic" approach to philosophy of science as linked to both the Aristotelian tradition and the hermeneutics of Collingwood and Gadamer, and with such modern proponents as Nicholas Rescher (Rescher 1982), Jaakko Hintikka (Hintikka 1976, 1979) and M. Sintonen (Sintonen 1984).

(14) See also Van Fraassen (1977) and (1980a).

(15) Belnap (1963).

actually gets its identity from the specific questions it asks. The *Meteorology* shows that Aristotle finds reviews of previous scientific theories crucial to the process of refining why-questions. As I have suggested above, for example, through his survey of the *endoxa* Aristotle progressively refines the *topic* of his why-questions about comets. The focus is no longer just on "Why are some stars long-haired?" but "Why are some long-haired stars so different in their behavior from other stars?" The *contrast-class* for comets clearly includes planets, since when the scientist asks "Why do comets appear anywhere in the sky?," there is an implied contrast to planets, which are restricted to the zodiac. And again, questions about the *endoxa* help to indicate just what will be *explanatorily relevant*. In relation to comets "Why are there numerous comets now?" involves a particular emphasis: "Why now, *during a hot and dry season*, rather than earlier, during a rainy cool season?" By surveying *endoxa* the scientist has been directed to observe which seasons are relevant to the appearances of comets.

Of course it could be objected that an Aristotelian scientist does not *need* to survey previous theories either to supply an initial list of *phainomena* or to order to acquire a clearly focused list of why-questions. Such data could be gathered and questions could be formulated *de novo*. I am unclear about how Aristotle would respond to this point. Comets are rare phenomena, not easily observed. Is it merely helpful to prepare for a possible viewing of a comet by reviewing earlier scientific accounts, or is it essential? My general sense is that, despite occasional passages suggesting otherwise (e.g. *Pr. An.* I, 30), Aristotle is not committed to an extreme form of (Baconian) empiricism, according to which an individual scientist directly confronts and draws hypotheses from the great masses of sensory data available (concerning comets, hail, or whatever) through the use of simple induction alone.¹⁶ It would be equally wrong to attribute to him the Popperian thesis that the goal of science is gradual progress via a slow process of accumulating data which will directly falsify earlier theories — far from it.¹⁷ In Aristotle's view, science can at least in principle be "finished,"

(16) This is a very difficult topic which I cannot address in detail here, as it would lead too far afield from the *Meteorology*. See, for some discussion of how Aristotle's description of the intuition of first-principles in science fits with his overall empiricism, Barnes (1975), pp. 248-260, esp. pp. 259-60. Also relevant are discussions in Owen (1961), Nussbaum (1982), and Bolton (1988) about the extent to which Aristotelian examinations of *phainomena* include conceptual analysis. Bolton criticizes an interpretation found in Barnes (1980) and Irwin (1981); as I noted above, Brunschwig (1987) suggests it is important that divergent opinions are often grounded in studies focused on different portions of the Aristotelian corpus.

(17) As expounded in Popper (1962). Kakkuri-Knuuttila and Kusch (1988) make the point that both the crude empiricist and falsificationist (or Popperian) rely on a simple view about how directly empirical observations can bear on scientific

and (as we shall see below) certain scientific hypotheses can be actually confirmed. What I have been suggesting here is another way to understand his insistence upon learning from previous thinkers. In particular, I have argued, the scientific investigator examines earlier views in order to refine why-questions and focus the direction of empirical observations. Of course, this should not be taken as grounds to attribute to Aristotle the extreme Kuhnian view that empirical observation in science is always guided by existing theoretical paradigms.¹⁸ One clear indicator that Aristotle has no concept of paradigm-guided science is his piecemeal approach to the "theories" of previous thinkers.

Part II. Signs and Proofs

A. SIGNS AND PROOFS IN THE *PRIOR ANALYTICS*

So far I have examined Aristotle's use of *endoxa* in structuring scientific accounts of various meteorological phenomena. In saying that these surveys create a *prima facie* obligation to provide superior explanations, I have suggested that Aristotle believes that his own accounts surpass rivals in explanatory power. He defends his own proposals not only by alluding to their superior ability to deal with the initially presented list of empirical *phainomena*, but also by claiming that he can account for certain new *phainomena*. These new "*sumbainonta*" or accompanying facts are often described as "signs" of various sorts. Aristotle discusses a variety of signs of earthquakes, for example, such as particular cloud-patterns or a special dimmed way the sun might appear on a cloudless day. We now know, thanks to studies of Sedley and others,¹⁹ that in the post-Aristotelian scientific tradition there were important debates about signs, also usually regarded as *sumbainonta*, or accompanying facts. In particular, the Stoics and Epicureans disputed whether such signs played a role in the discovery or evidential support of particular scientific hypotheses. Aristotle's treatment of signs in the *Meteorology* is a neglected antecedent to this later debate.

hypotheses. Despite Popper's influence, this simple view has been considered dubious in philosophy of science for some time, by Kuhn and others too numerous to list (but including at any rate philosophers as otherwise diverse as Duhem, Feyerabend, Grünbaum, and Quine).

(18) Kuhn (1970). Kakkuri-Knuuttila and Kusch (1988) point out that there are natural links between what they describe as the question-theoretical approach in philosophy of science and Kuhn's notion of paradigm-guided inquiry, and they note that these connections have been pursued by Stephen Toulmin in Toulmin (1972).

(19) See Sedley (1982); he discusses, among others, writings by Michael Frede and Gisela Striker.

Now, meteorology even today seems to be a science concerned with the informed interpretation of signs. We say along the Gulf Coast that muggy weather and soft breezes are a sign that a cold front is about to pass through; in the Midwest people interpret dark green clouds and rapidly decreasing barometric pressure as signs of an approaching tornado; and I have heard it alleged that the behavior of cows or other animals can give some sign of an impending earthquake. Does Aristotle's use of signs in this case amount to anything more than this?²⁰ I think there is no doubt that it does. Aristotle is actually concerned less with treating various meteorological phenomena, in the sense of *things*, as signs, than with analyzing why they can be read as signs.

The terms "sign" (*sēmeion*) and "proof" or "index" (*lekēmērion*) are introduced into technical usage in *Prior Analytics* II, 27. In a recent discussion of this chapter, Myles Burnyeat has noted that here Aristotle is more interested in a concept of signs as *inferences* than in the more ordinary sense in which we might call spots, say, a sign of measles.²¹ Aristotle explicitly defines the term "sign" via its function in certain kinds of reasoning:

A sign ... means a demonstrative premiss which is necessary or generally accepted. That which coexists with something else, or before or after whose happening something else has happened, is a sign of something's having happened or being (70a8-10).

Aristotle contrasts a sign to a "probability" (*eikos*), although he may mean (as Burnyeat believes) to treat the latter as a type of sign — the type involving "generally accepted" rather than "necessary" premises. Syllogisms, here called enthymemes, may involve either probabilities or signs. Aristotle must mean that reasoning with either is enthymatic or incomplete when only one premise is stated.

In general Aristotle holds that "truth can be found in all signs" (*alēthes men oun en hapasin huparxei lois sēmeiois*; 70a38). However, signs differ according to the sorts of syllogistic reconstructions which may be offered to represent the inferences they involve. Particularly valuable are signs representable by syllogisms in the first figure: "[A] syllogism in the first figure cannot be refuted if it is true, since it is universal." To illustrate this sort of case, Aristotle cites this example: Having milk is a sign that a woman is pregnant. There is, supposedly, a universal connection between having milk and pregnancy.²² Logically, we get this reconstruction in a first figure syllogism:

(20) The reader may notice that I sidestep tough questions here about the status of signs in the contemporary "science" of meteorology.

(21) Burnyeat (1982), pp. 194-99.

(22) Burnyeat discusses the factual problems of this case; see Burnyeat (1982), pp. 204-5, n. 30.

All woman who have milk are pregnant. (All) B is A.
 This woman has milk. (Some) C is B.
 This woman is pregnant. (Some) C is A.

This sort of case is contrasted to others in which signs may be represented by invalid second or third figure syllogisms. Aristotle first summarizes by calling a sign in general, as a middle term, an "index" or "proof" ("*tekmērion*") of something: "For the name 'index' (*tekmērion*) is given to that which causes us to know, and the middle term (*to meson*) is especially of this nature" (70b1-4). However, just after this remark he seems prepared to reserve the label "*tekmērion*" to apply only to those signs which are representable as middle terms in *valid* first-figure syllogisms.²³ In other words, having milk serves as "proof" that a woman is pregnant,²⁴ but other signs may not be proofs.

Now it is clearly the case, but still worth mentioning, that a proof is not the "cause" of whatever it is proof of: having milk does not cause being pregnant, but is in fact caused by it. Nevertheless this, like other signs, is "that which causes us to know". Our awareness of the one fact (that the woman has milk) is grounds for inferring the other fact about the woman (that she is pregnant). Indeed, Aristotle maintains that "the conclusion which is reached through the first figure is most generally accepted and most true (*endoxotaton gar kai malista alēthes*)" (70b5-6). But we must be careful here, because strictly speaking, Aristotle holds that only "the" cause, i.e. the true cause, is a cause of our knowing, i.e. *validly demonstrating* (cf. *Post. An.* I, 2) the conclusion that the woman is pregnant. The true cause is the basis for proper inference because it represents the order of being as it really is. Aristotle's causal explanation for the presence of milk in humans is provided within his discussion of human pregnancy in *Generation of Animals* IV, 8. As we would expect, he there describes a final cause—nurturing the infant—and also a material/efficient causal story. The latter involves an excess of material in the pregnant woman at around seven months or so. Aristotle thinks that, as the process of baby-building nears completion, "then there is more surplus residue, because less of it is being used up..." (776a31-3). This surplus residue takes the form of milk. In other words, pregnancy causes having milk because through insemination the male's heat has introduced a "concocting" agent into the woman's body. This agent directs that her available material be put to service, and seven months or so into the process it also results in her having milk. So, according to the *Posterior Analytics*, genuine

(23) This is how Burnyeat takes him, too. See Burnyeat (1982), p. 196.

(24) There are important considerations here about the modal and epistemic status of the true universals involved in syllogistic reconstruction of proofs. Burnyeat discusses these in Burnyeat (1982), pp. 204-5.

knowledge about "Why is this woman pregnant?" requires knowing the facts about insemination and nurturing infants; and only such knowledge counts, strictly speaking, as "the" cause both of our knowing that the woman is pregnant and that (consequently) she has milk. Knowledge through signs might show us *that* the woman is pregnant, but it does not explain *why*.²⁵

B. SIGNS AND PROOFS IN THE *METEOROLOGY*

I have emphasized these points about various sorts of grounds for knowledge and inference because we need to be clear about them so as to understand Aristotle's claims about signs and proofs in the *Meteorology*. In an informal survey (based on the citations in Lee's index) I have found 19 occurrences of the term "*sēmeion*" together with four occurrences of "*tekmērion*" in something like the technical (inferential) use set forth in the *Prior Analytics*.²⁶ It is, to be sure, difficult to force some of these occurrences into any clear inferential pattern; some may be ordinary everyday uses, as when Aristotle speaks of snow as a sign of a cold season or country (I, 11, 347a28). Once he counts something as a sign which corroborates something else he took to be an initial fact: the fact that hailstones are not rounded off is proof that they're frozen close to the earth (I, 12, 347a33). In a more interesting passage about dew and frost he cites the fact that they aren't formed on mountains as a sign that they're due to vapor not rising very far. We will see longer and more elaborate examples along these lines in a moment.

One rather remarkable sign mentioned in this text must be counted as among the type Aristotle describes in the *Prior Analytics* as merely probable or an *eikos*. This sign is mentioned at II, 1 in his discussion of why the sea cannot have sources, and of how rivers flow from higher parts of the earth, those towards the north. Here Aristotle writes,

An indication that the northerly parts of the earth are high is the opinion of many of the ancient meteorologists that the sun does not pass under the earth but round its northerly part, and that it disappears and causes night because the earth is higher towards the north (354a27-32).

(25) Burnyeat rejects Ross' ("natural") view that a sign must be more familiar or knowable than what it signifies, and he claims that in the *Prior Analytics* "Aristotle's account of signs makes no use of epistemic notions" (p. 205). According to Burnyeat, Aristotle leaves it open that "pregnancy could be a sign of lactation." I agree that this is so. However, what is crucial about a proof is that it is a cause of our knowing something, although on its own it cannot count as *the* cause; to obtain *the* cause we must arm ourselves with a proper scientific demonstration.

(26) As Burnyeat notes, Aristotle elsewhere uses *sēmeion* more informally: to designate things rather than propositions or bases for inferences. See Burnyeat (1982), p. 194, n. 3.

This passage is especially interesting because Aristotle cites as a "sign" (*sēmeion*) something which is merely said to have been believed by the ancients—a clear reference to an *endoxon* which he tries to use to lend support to his own theorizing.

The most extended and complex allusions to signs in this work, together with mention of *lekmēria*, seem to cluster around three especially problematic phenomena in meteorology: comets, earthquakes, and the saltiness of the sea. In the next sections I will consider the first two of these examples in more detail, to uncover the inferential structure and scientific methodology at work in them.²⁷

C. COMETS

As noted in section IF above, Aristotle uses his own account of comets to explain certain empirical data about comets collected during his survey of the *endoxa*, such as their rarity, paths in the sky, shapes, and relations to stars. Toward the end of his discussion, and after providing his own explanation, Aristotle attempts to lend persuasiveness to his account of comets by discussing a new empirical point: comets are likely to occur during seasons that are windy and dry (344b28ff). He says that a multiplicity of comets "signify" (*sēmainousi*) wind and drought (there are subtle variations, such as the claim that when comets are smaller or dimmer, the wind or drought are less noticeable). We can draw an instructive parallel between this example of a sign ("Frequent comets signify wind and drought") and the example from the *Prior Analytics* ("Milk signifies that a woman is pregnant") as follows:

All seasons with frequent comets are windy and dry.	All B is A.
A certain winter was a season with frequent comets.	This C is B.
A certain winter was windy and dry.	This C is B.

Recall that, although milk is a sign of pregnancy, it does not cause it; rather, certain facts associated with pregnancy cause a woman to have milk. So also Aristotle believes that comets signify, but do not cause, wind and drought; rather, factors involved in the wind and drought (i.e., a predominance of masses of hot dry exhalation) also cause the occurrence of multiple comets. Each sign could be classified as a "proof" of what it signifies, since in each case the sign is a "most reputable" cause of our knowing the associated phenomenon.

It might be objected that there is insufficient evidence to treat the example about comets just discussed as a "proof" or sign representable in a valid first-figure syllogism. Signs which are to count as *lekmēria*

(27) I discuss the third and longest of these cases in Appendix I, "The Saltiness of the Sea".

could be described as sufficient conditions of what they signify. Aristotle does in fact maintain that the appearance of multiple comets is a sufficient condition of a windy and dry season. Indeed, he argues not only that multiple comets are a sign of wind and drought but that *this fact* (this signifying relation) is *itself* a proof (*lekmērion*) of the correctness of his account of comets—it confirms his view that their constitution is fiery (344b19-21). Recall that milk is a proof of pregnancy *because* these two *palhē* can be connected in a valid first figure syllogism. But this isn't the whole story: these *palhē* are connected *because* the actual factors that cause pregnancy (those demonstrable by a scientific syllogism) also explain why a woman has milk. Now here, similarly, multiple comets are proof of a dry windy season *because* there is an appropriate and universal connection between comets and windy dry seasons. Again, this isn't the whole story: the true scientific cause for windy dry seasons, predominant masses of the hot dry exhalation, would also be cited in the scientific explanation of the frequent occurrence of comets. Here Aristotle goes beyond the *Prior Analytics* account, by citing a particular sign relation as itself evidence ("proof") for his background scientific explanation; I shall have further comments about this special use of "*lekmērion*" in my Section E below.

D. EARTHQUAKES

Aristotle holds that earthquakes occur when the hot dry exhalation in its dynamic form as wind is forcibly and rapidly thrust into various hollows of the earth. As usual, he collects various data about earthquakes in the course of his preliminary survey of the *endoxa* (here in II, 7, he reviews proposals from Anaximenes, Democritus and Anaxagoras). It is especially noteworthy that he criticizes Anaxagoras' view for failing "to account for any of the peculiar features of earthquakes, which do not occur in any district or at any time indiscriminately" (365a34-6). In the very long chapter II, 8 Aristotle first gives his own account of earthquakes and then proceeds to show how his theory proves superior to that of Anaxagoras in explanatory power. Indeed, he marshalls together an amazing number of features of earthquakes which (he thinks) he can account for; none of these empirical facts²⁸ were noted in his treatment of Anaxagoras or, indeed, before he provided his own definition. Thus he explains in considerable detail why most earthquakes occur in calm weather, at night, in places "where the sea is full of currents or the earth is porous and hollow",

(28) It should be obvious that I have been using the term "explain" throughout this paper, but especially in this section, in the sense of "purport to explain," and here similarly I speak of "empirical facts" as "what Aristotle takes to be empirical facts".

most often is spring and autumn or during rains and droughts, at an eclipse of the moon, with aftershocks, with noises preceding them, with accompanying jets of water or tidal waves, in narrowly circumscribed localities, in the form of either (horizontal) shudders or (up-and-down) throbs, more rarely on islands far out to sea..., etc. And he concludes with perhaps justifiable pride by saying "This completes our examination of the nature and causes of earthquakes, and of their most important attendant circumstances (*sumbainonla*) (369a8-9)".

Now, in the course of setting forth this whole series of explanations Aristotle several times mentions signs or proofs. In the first passage he claims that there are "signs of these things" (viz. of his account) in certain observations about earthquakes which didn't cease until wind broke out with hurricane force (366b31ff). Again, we can call upon the *Prior Analytics* discussion to represent the inference Aristotle has in mind as taking a form something like this:

In every case of turbulence where the wind escapes, the earthquake ends.

In this case of turbulence the wind escapes.

In this case of turbulence the earthquake ends.

Escaping wind is a sign of an earthquake's ending since an earthquake is a sufficient condition for trapped wind. Once more, the sign reveals the phenomenon *because* it indicates something that is causally connected to it.

In the next paragraph, Aristotle speaks of a proof (*tekmērion*) that winds circulate beneath the earth:

For when a south wind is going to blow it is heralded by noises from the places from which eruptions occur. This is because the sea, which is being driven forward from far off, thrusts the wind that is erupting out of the earth back again when it meets it. This causes a noise but no earthquake because there is plenty of room for the wind, of which there is only a small quantity and which can overflow into the void outside. (367a15-20)

This passage claims first that noises within the earth are a sign of a (south) wind. It then explains that this signifying relation holds *because* Aristotle's account of earthquakes is correct: the rumbling noises signify south wind because they are like a mild earthquake which occurs due to the wind's being trapped under the earth.

Here and in the next use of the sign terminology in this chapter Aristotle is arguing, just as he did concerning comets, that his ability to explain particular signs indicates that his account is correct. He notes,

Further evidence that our account of the cause of earthquakes is correct is afforded by the facts that before them the sun becomes misty and dimmer though there is no cloud; and before earthquakes that occur at dawn there is often a calm and a hard frost.

In this passage Aristotle mentions two concomitants (*sumbainonla*) of earthquakes; these signs (*sēmeia*) can again be regarded as sufficient

conditions for the presence of the crucial causal factors of earthquakes. That is, there is a universal connection between the misty dimmed sun on cloudless days and earthquakes; in his next paragraph Aristotle uses the phrase "necessarily" three times and also speaks about causal processes which follow from the essential nature of heat by itself (*kath'haulēn*). A misty dimmed appearance of the sun on a cloudless day signifies an earthquake *because* both are caused by the same general factors: "The sun is necessarily misty and dim when the wind which dissolves and breaks up the air begins to retreat into the earth". Cold and calm also signify earthquakes *because* they too are related to the "right" causal conditions: Before an earthquake, "the exhalation, which is by nature essentially warm, is directed inwards":

So the warm element disappears into the earth, and wherever this happens, the vaporous exhalation being moist condenses and causes cold.

Yet another closely related "sign" of earthquakes can be similarly explained. Sometimes earthquakes are signalled by a fine long streak of clouds in the sky or of breakers in the sea:

The wind produces the same effects on the cloud in the sky as the sea on the shore, so that when there is a calm, the clouds that are left are all straight and fine like breakers in the air.

Here too, the sign that indicates an earthquake does so, Aristotle tell us, *because* it is related to what he has argued is the real cause of earthquakes, the exhalation (suitably qualified). Aristotle explains numerous other features associated with earthquakes in terms of his core account (of exhalation rushing inwards); though they are not explicitly referred to as signs, it seems likely that in many cases the *pathē* under consideration could count as such. Thus the noises in the earth before earthquakes could be heralds just as the fine line of clouds would be; or, again, the fact that Aristotle can explain aftershocks should be taken to lend credibility to—or to serve as a sign for the truth of—his causal accounts.

In one final case which is importantly different Aristotle cites something which could not be treated as a sign of earthquakes in this same sense, namely, an eclipse. He remarks that "sometimes" the two phenomena are associated. Perhaps, since the connection between these two phenomena is not universal, an eclipse is only a somewhat trustworthy sign of an earthquake. Even in this case there is some background cause linking the two phenomena: a type of wind that was being held in counterbalance by heat from the moon rushes back into the earth as the moon's heat subsides during the eclipse. Thus an eclipse is after all a sign, a somewhat trustworthy bit of evidence that something is going on which will probably affect balances of light and warmth affecting the earth's wind systems; and these imbalances in turn *might* get translated into the dramatic causal forces resulting in an earthquake.

E. SIGNS, PROOFS AND ABDUCTION

In these arguments of the *Meteorology* Aristotle is doing far more than informing readers about how to interpret various weather signs; he is employing a venerable, if questionable, strategy for the defense of scientific realism, the strategy of "abduction". Roughly, this strategy involves arguing from explanatory success to the truth of a scientific theory. As a scientific realist Aristotle is committed to maintaining that it is in principle possible for a scientific theory to provide true and accurate accounts of the actual causes of the empirical phenomena it investigates. In meteorology, for example, Aristotle would maintain that the exhalations which are fundamental principles of meteorology really do exist and do function in just the ways his theory describes.²⁹ What evidence can be cited for this conviction? Abduction is a form of inference to the best explanation: the best explanation for a theory's predictive success is that it is true, i.e. that it describes the world as it really is. Indeed, abductive arguments maintain that "the (approximate) truth of a scientific theory is the only possible explanation of its predictive success".³⁰ Even if Aristotle is arguing merely that his theoretical explanations seem workable, and that this constitutes some reason to believe them, he is employing an interesting and controversial strategy.³¹ But he often (either explicitly or implicitly) argues for more, that his theory's workability provides a proof of its correctness, or a valid ground for the inference that his causal story is a true one.

Contemporary anti-realists criticize abductive arguments as circular or question-begging³² because abduction involves a sort of defense of induction through the use of induction. In a recent discussion, for example, Richard Boyd briefly sets out the antirealist argument as follows:

The issue of scientific realism is—at least insofar as the dispute between realists and empiricists is concerned—a debate over the legitimacy of inductive inference to the best explanation... Arguments for realism ...

(29) However, Aristotle's chapter on comets contains a puzzling and anti-realist methodological remark which I discuss in Appendix II, "An Anomalous Methodological Remark".

(30) As phrased by Leplin (1984), p. 1.

(31) For Epicurean uses of something like this strategy — i.e., citing compatibility with *sumbainonla* as a form of evidence for a theory — see Sedley (1982), esp. pp. 266 ff. on non-contestation. See also Appendix II below.

(32) However, this topic is most often addressed in relation to scientific theories referring to theoretical entities, so what is at stake in particular are realist commitments to the existence of these entities. For a helpful introduction, see Leplin (1984), esp. pp. 1-7. Also relevant are the essays included in Churchland and Hooker (1985).

employ just this sort of inference, and thus, simply beg the question between realists and empiricist antirealists.³³

How exactly could Aristotle defend his abductive strategy of citing signs as evidence for the truth of his own causal hypotheses? In some cases he could point to background deductive arguments; as I have indicated above, he views certain especially interesting signs as sufficient conditions of what they signify. In these cases, reasoning from a sign to a phenomenon is valid because, as Aristotle explained in the *Prior Analytics*, there is some universal connection between relevant *pathē* (e.g. pregnancy and milk) which can be represented in a deductively valid first-figure syllogism. But what provides such syllogisms themselves with scientific support? How, for example, can the scientist be sure of possessing the right background syllogism of a science, for example a demonstrative explanation from biology which would explain why women get pregnant? Here Aristotle is arguing that usefulness provides at least partial corroboration of such a causal account. There is more than one reason to believe one has the genuine scientific account if the same causal story can explain several *pathē*.

Perhaps Aristotle's treatment of signs as inductive evidence for the truth of scientific claims reflects his more relaxed use of "sign" in *Prior Analytics* II, 27; recall that there he maintained that signs of all types have a role in revealing truth. Signs point us toward an understanding of the real cause of a signified phenomenon. Burnyeat emphasizes in his review of the *Prior Analytics* doctrine of signs that

...the purpose of this technical exercise is *not* to reject the inferences which do not admit of a formally valid reconstruction (Burnyeat 1982, p. 196).

As Burnyeat sees it, in allowing all signs some value in indicating truth, Aristotle opens the door to forms of non-deductive inference. This move is crucial for the philosophy of science; indeed, Burnyeat believes that Aristotle's logic is more open and potentially useful for philosophy of science than that of the Stoics who followed him:

If one believes that an adequate philosophy of science must find a place for nondeductive as well as for deductive logic, one will conclude that, as logicians, Aristotle was a better friend to the sciences than Zeno and Chrysippus (Burnyeat 1982, p. 238)³⁴

(33) Boyd (1984), p. 66. The anti-realist he is describing is Arthur Fine, and the realist arguments mentioned here are said to be those "of the sort Fine criticizes".

(34) For further discussion of development of signs within philosophy of science, both by the Stoics and by Epicurus, see also Sedley (1982). The role of signs in confirmation in the *Meteorology*, as I proceed to interpret it, has interesting parallels to their role in Epicurus' theory, as set forth by Sedley; see especially his pp. 267-69 and 270-71.

In saying that a sign supplies evidence that is *endoxalaton* or *malista alēthes* (most reputable and most true) for a conclusion, Aristotle "implies that the inferences reconstructed in other figures do have some, though a lesser, claim to reputability and truth" (p. 197). Even non-"proof" signs represent "certain common and useful inferences of ordinary life" (p. 196).

I believe that Aristotle accords certain signs an important evidential role in arguing for the truth of his proposed definitions of meteorological phenomena. Even a sign of a non-proof category can serve as a "reputable" (*endoxon*) indicator of a fact. This is so because all signs are related in *some* way to a properly demonstrative syllogism. An eclipse, for example, is a sign but not a proof of an earthquake.³⁵ In this case Aristotle offers a single causal explanation which helps account for both phenomena, without requiring that they be universally or necessarily associated. The sign is a sign because there is a background link; furthermore, Aristotle cites the sign as partial evidence that he is right about this link.

In other cases the signs Aristotle describes have closer and more integral connections to the phenomena they signify, even if they are not explicitly regarded as "proofs". Thus Aristotle remarks that a misty dimmed sun signifies an earthquake; and he also explains why. He argues that this sort of sun is a sign of earthquakes *because* his causal account of earthquakes is true. What is the structure and purpose of this argument? Aristotle marshalls explanations of why various things as well as this one are signs of earthquakes in order to defend the plausibility of his own account of earthquakes. He believes that he can go beyond explaining the initial data about earthquakes, so as to explain the *sumbainonta*, the associated empirical facts which are signs of earthquakes. Thus signs function evidentially in support of his causal hypotheses.

As Burnyeat suggests, signs allow Aristotle the use of certain everyday forms of inference. In the *Meteorology* Aristotle uses signs as part of an argument form involving more than inductive inference to *phenomena* (of the sort practiced by everyday "weathermen"); instead, using an abductive strategy, he constructs inferences to the *correctness of his accounts of phenomena*. The structure of such inferences is very clear in those cases in which Aristotle describes certain sign relations as themselves signs of the accuracy of his own accounts. When Aristotle says that the fact that comets signify wind and drought is itself a sign (*tekmērion*) of the correctness of his causal analysis of comets, he is

(35) Surely a variety of the phenomena Aristotle calls signs of earthquakes will also fall into this category of non-proof signs; see also Appendix I below, on the saltiness of the sea.

really invoking a sort of *meta-sign*. That is, he takes the fact that something is a sign as itself the sign of something else—of the truth of his analysis of comets. This move is not exactly envisaged in the *Prior Analytics* discussion of signs, but neither is it incompatible with that discussion. Aristotle seems to argue as follows:

The fact that comets are a sign of wind and drought is a sign that my account of comets is correct. The possessor of a true and adequate account of causes can also explain why comets are a sign of wind and drought.

We can compare this reasoning to a parallel reconstruction of his *Prior Analytics* exposition:

The fact that having milk is a sign of pregnancy is proof that my account of why women have milk is correct. There must be a true and adequate explanation for why women have milk, and the possessor of this true and adequate explanation can also explain why milk is a sign of pregnancy.

Aristotle reasons in this complex way in the *Meteorology* both here in his claim about comets and also in the passages I discussed about earthquakes. Certain signs are valid indicators of phenomena *because* they bear a special relation to the true causal analysis of those phenomena; and Aristotle would cite this same point in explicating the *Prior Analytics* example of a *tekmērion*. It is just this italicized "*because*" that Aristotle invokes with his use of meta-signs in the *Meteorology*.

Other signs function in less rigid argument-patterns as indicators that Aristotle's definitions of meteorological phenomena are correct. These signs usually involve empirically observable facts, *phainomena* or *sumbainonta*. These facts are functionally parallel to the facts cited earlier during Aristotle's surveys of *endoxa*; they can be paired up with the initial *endoxa* in three significant ways. First, all these facts could be cited in a new and revised list of the *endoxa*, or most reputable facts of this science. Second, there are all particular sorts of *endoxa*, empirical facts available to *aisthēsis*; as such, they ought to be accounted for by the scientist even if they are not universally or necessarily associated with the subject under investigation. Third, and finally, by claiming that his hypotheses do explain all these facts, both those recorded initially and those added on as signs or proofs, Aristotle provides inductive evidence for the truth of his own scientific theory.

Part III. The Pragmatics of Explanation

How is Aristotle's procedure in the *Meteorology* related to the formal outline of scientific method he presents in the *Posterior Analytics*? On the most obvious level the *Meteorology* differs from the pure model by its inclusion of the two main features I have examined in

this article, surveys of *endoxa* and citation of signs and proofs.³⁶ But this question is made more difficult to answer by recent disputes about the actual purpose of the *Posterior Analytics*' outline of demonstratively rendered scientific knowledge. In his article "Aristotle on Understanding Knowledge", Myles Burnyeat has challenged the interpretation which he says "promises to become a new orthodoxy", that advanced in Jonathan Barnes' Clarendon edition of the *Posterior Analytics*.³⁷ In brief, Barnes argued that the *Posterior Analytics* advocates demonstration not as a method of discovery or a model of explanation, but as the best organization for teaching or imparting knowledge. Burnyeat responds with two critical points. First, he argues, Aristotle was himself too good a pedagogue to have believed that demonstration from first principles was the most effective way to teach or convey knowledge (pp. 116-17). Instead, he frequently emphasizes the need to begin by citing what is more familiar "to us" or to the students of a discipline. (This way involve beginning from the *endoxa*, for instance.) Second, Burnyeat presents an elaborate case for translating Aristotle's term "*epistēmē*" (usually translated as "scientific knowledge") as "understanding". His point is that, for Aristotle, *epistēmē* involves not only knowing a proposition but being in a position to explain it by suitable demonstration of it from first principles. Burnyeat emphasized that a proposition can be *known* without being understood—indeed, this is likely to be the position of a young student or learner. Converting knowledge into understanding may ultimately involve conveying the science's first principles to the learner; but more immediately what is required are some first steps which enable the learner to begin making the proper connections to other familiar items.

Burnyeat's interpretation of Aristotelian *epistēmē* as "understanding" is problematic for a variety of reasons.³⁸ The key contrast he

(36) This is leaving aside questions about just how Aristotle's definitions in this science conform to the demonstrative/syllogistic guidelines set out in the *Post. An.* In Freeland (1986) I argue that there is general conformity, although Aristotle's use of multiple causal accounts (e.g. accounts combining both material and formal causes) of the same phenomena complicates the picture.

(37) Burnyeat (1981); Barnes (1975).

(38) On Burnyeat's view, a single proposition can be the object of two distinct cognitive states. At first it is *known* and subsequently it is *understood* when the knower acquires a demonstration of it. But Aristotle describes such shifts in *cognitive state* as, indifferently, shifts in the *object known*. For example, he writes in the *Posterior Analytics* II, 8 that a scientist who knows the definition of either thunder or an eclipse will know the relevant syllogism. Knowing the essential nature of either phenomenon is just knowing its cause: that thunder, for example, is "the quenching of fire in cloud" (he says here). Notice that it makes no sense to say that one could "know" this proposition in Burnyeat's sense of "restricted knowledge": to know it is to understand it.

develops between "knowledge" and "understanding" is said to reflect "two things which present day philosophy segregates into distinct areas of inquiry (p. 97)". These are first, "an account of the conditions for a proposition to belong to a body of systematic knowledge like geometry, physics or botany"; such an account belongs, says Burnyeat, to the discipline of philosophy of science. Science, there is "an account of the cognitive state of the individual person who has mastered a body of systematic knowledge"; this second thing belongs to the realm of epistemology. "Knowledge" is taken to be roughly sketched out as in traditional epistemology which views it as justified true belief. *Scientific* knowledge or "understanding" requires incorporating a known item in specified ways within a larger body of information with unifying laws and principles. Here Burnyeat cites Michael Friedman's article, "Explanation and Scientific Understanding"³⁹ as setting out the paradigm (and he thinks it one Aristotle could agree to). As Friedman has characterized it, "scientific explanation is in the first instance explanation of generalities (laws) rather than the explanation of particular events" (p. 109).

But as a matter of fact, explanation is a very controversial notion in contemporary philosophy of science. In a recent article "Explanation and Realism", Clark Glymour notes that there are three main contemporary approaches to scientific explanation:

Philosophical theories of scientific explanation can be roughly divided into three types: purely logical theories, which analyze explanation solely in terms of logical relations and truth conditions; theories with extra objective structure, which impose objective conditions on explanation beyond those of truth and logical structure; and theories with extra subjective structure, which impose on explanations psychological conditions of belief, interest, and so forth.⁴⁰

Glymour places Friedman, whose account Burnyeat relies upon, in his second category. For our purposes, however, it is more interesting to consider representatives from Glymour's third category.⁴¹ Peter Achinstein, for example, in *The Nature of Explanation* criticizes certain philosophers like Carl Hempel for regarding explanations as *entities* of certain sorts rather than focusing on explanatory *acts*.⁴² On his view, a

(39) Friedman (1974).

(40) Glymour (1984), p. 178.

(41) Glymour mentions Achinstein, Skyrms, van Fraassen, and ("recently") Putnam.

(42) Achinstein (1983); see esp. pp. 5-7 and Chapter 3, "What is an Explanation?" Actually Achinstein criticizes Aristotle along with Hempel, but I think his understanding of Aristotle is limited, and at any rate he only mentions Aristotle briefly. It may be that Aristotle holds the ontological view of explanations that Achinstein attributes to him (and others, like Hempel) although he is still sensitive to the sort of pragmatic concerns emphasized by Achinstein and others. I will discuss these topics further in Freeland (1991).

theory of explanatory acts is more important because it can take into account the important issues of *illocutionary force* and *emphasis*.

Another representative of this third category is Bas van Fraassen, whose book *The Scientific Image* I have mentioned earlier.⁴³ In writing about the "pragmatics of explanation" Van Fraassen actually credits Aristotle's multiple-causal analysis as incorporating just the sort of considerations Achinstein emphasizes. Van Fraassen⁴⁴ also draws an important distinction between the *descriptive* and *explanatory* roles played by the statements of a science. What seems to be a single why-question might actually involve a variety of possible explanatory concerns. Or again, one descriptive statement might be the answer to a variety of explanation-questions. In fact, the same statement may play both descriptive and explanatory roles, depending upon context:

...[I]f you ask a scientist to explain something to you, the information he gives you is not different in kind (and does not sound or look different) from the information he gives you when you ask for a description. Similarly in 'ordinary' explanations: the information I adduce to explain the rise in oil prices, is information I would have given you to a battery of requests for description of oil supplies, oil producers, and oil consumption. To call an explanation scientific, is to say nothing about its form or the sort of information adduced, but only that the explanation draws on science to get this information (at least to some extent) and, more importantly, that the criteria of evaluation of how good an explanation it is, are being applied using a scientific theory...⁴⁵

Because explanation is a description *which answers* a particular why-question, Van Fraassen describes explanation as not simply a two-term relation between theory and fact, but rather a three-term relation between theory, fact, and *context*. In describing context Van Fraassen further discusses the logic of why-questions (also mentioned in my section IG above). In particular, the features of "relevance" and "contrast-class" are crucial to determining what is really sought from an explanation.

This extremely minimal sketch of Van Fraassen's view of explanation should still be enough to suggest a viable alternative to Burnyeat's interpretation of how Aristotle views scientific explanation. Burnyeat represents Aristotelian understanding as a fairly simple two-term relation between a proposition or fact and the first principles of the theory it is embedded in/derivable from. But Aristotle's interest in the asymmetries of explanation and in multiple causal accounts should alert us to the fact that explanation is for him a more complex relationship, one involving preparedness to answer why-questions which

(43) Van Fraassen (1980b).

(44) Van Fraassen (1977, 1980a).

(45) Van Fraassen (1980b), pp. 155-6.

arise *for* observers and *in contexts*.⁴⁶ As I argued above, Aristotle uses evaluations of the *endoxa* in this science to refine why-questions; this creates an expectation about what it will take to "understand," say, comets or hail. This scientist who truly understands comets has in hand a descriptive theory involving the hot dry exhalation, but this involves "knowing" more than a mere definition, and it also involves "understanding" more than simply how to deduce this definition from certain better known first principles. In virtue of knowing that "a comet is a combination of the hot dry exhalation with an igniting principle," the scientist also knows the answers to a host of why-questions, so "understands" and is prepared to explain why comets are rare, why they appear anywhere in the sky, sometimes but not always with a star, more often in dry season, etc. Similarly, the person who "understands" hail knows not only how to define hail by citing first principles — the exhalations — but also can explain the answers to a variety of why-questions about hail: why does bigger hail fall from clouds nearer the earth, why doesn't it hail in winter as much as in the fall, why do hailstones get rounded under certain conditions, etc. And the person who understands earthquakes can explain why they sometimes occur during eclipses of the moon, or are heralded by a dimmed and misty sun.

If this context-dependent account of explanation indeed belongs to Aristotle, then we must recognize a second major limitation of Burnyeat's interpretation. Not only does he draw a sharp distinction between knowledge and understanding, but he also distinguishes processes of understanding and of scientific discovery. Notice how these two are dichotomized in the following passage from Burnyeat's article:

Teaching in the sense of imparting knowledge to people who did not have it before must normally include the citing of evidence and justification. The path by which the pupil is led to knowledge which is new to him cannot be wholly unconnected with the path by which the teacher won that knowledge in the first place. (I am referring here to the evidential base for a scientific discovery, not to the methods used in the search.)⁴⁷

(46) This may seem puzzling in light of Achinstein's criticism of Aristotle for his emphasis on entities rather than illocutionary explanatory acts. I believe that van Fraassen has better understood the impact of Aristotle's use of multiple forms of explanation; see Van Fraassen (1980a), "A re-examination of Aristotle's Philosophy of Science". But I am also arguing in this paper that Aristotle places more emphasis on "the pragmatics of explanation" in an actual treatise like the *Meteorology* than in his formal model for science in the *Posterior Analytics*. I return to the topic of Aristotelian pragmatics of explanation in discussing the *Physics* on "accidental causes" in Freeland (1991), currently in ms. draft.

(47) Burnyeat (1981), p. 117.

But as I see it, it does not make good sense to separate the "evidential base" from "methods used in the search," as Burnyeat does in this passage.⁴⁸ It is certainly true that the evidential base for a scientific definition will involve some allusion to indemonstrable first-principles; the scientific inquirer may have to discover these "self-evident" principles through induction. (Aristotle does begin in the *Meteorology*, roughly, by setting out his first-principles, but he does not simply present them with the claim that they are obvious and self-certifying; rather, he argues for them and even surveys *endoxa* concerning them.) Again, a working scientist might stumble onto accounts of particular phenomena, in a process unnecessary to recount in providing subsequent argument for these accounts/definitions.

But, as I have just pointed out, there is more to scientific understanding and explanation than the mere possession of definitions derived from first-principles. "Understanding" involves a correlative ability to explain, i.e. to turn the descriptive statements of this science (those learned in the definitions) to good use in responding to a variety of questions which will arise for the scientist as inquirer or teacher. These questions reflect particular presuppositions — about topic, questioner, relevance, contrast-classes, and so on. Imagine two questioners: one, the inquiring scientist seeking to understand hail, and one the student (or rival scientist) asking Aristotle for the evidential basis of his account of hail. The investigator might ask a questions like "Why does hail fall more often in all than in winter?" and then seek an explanation for this *phainomenon* about hail. The student or rival might ask Aristotle exactly the same question, with the expectation of receiving some evidence for his account of hail. And both questioners might well be satisfied by — glean understanding from — the same answer: "Because hail is caused when the cool moisture in a cloud is compressed into heavy ice by warmth outside the cloud." So when Aristotle mentions this explanation in his text, what is he doing — recounting his own process of inquiry, or citing the evidential base for his discovery?

In other words, I find it plausible to regard the *Meteorology*, as Aristotle has composed it, as *either* a record of real scientific inquiry and research *or* a listing of the evidence for his proposed theoretical accounts. Furthermore, since teaching science involves conveying explanations to students who ask a variety of sorts of why-questions with particular topics, relevant contrast-classes, etc., this treatise could

(48) It is instructive to compare my view with Brunschwig's claims that it would be artificial to describe dialectic, as set forth in the *Topics*, as either strictly a method of discovery or a method of justification. ("Mais, sur le plan historique, cette dissociation entre découverte et justification risque, me semble-t-il, d'introduire certaines distorsions dans la lecture des *Topiques*.) See Brunschwig (1987).

very well serve as the text in an ancient class on meteorology. In ascribing to Aristotle this emphasis on the pragmatics of explanation, I do not mean to ignore the role of demonstrations and first-principles within this (or any) science. For Aristotle, the actual discovery of a middle term, i.e. grasping the cause which connects a phenomenon to the first-principles, remains something unanalyzable — a job for induction, *noûs*, quickness of wit. I have not focused on this process here. Instead, I hope to have shown that in this actual scientific treatise Aristotle's procedure departs from the restrictive ideal set forth in the *Posterior Analytics*, within discussions that could be seen merely as rhetorical flourishes preceding and following upon the crucial business of science (the laying down of demonstrations and definitions). However, these "flourishes" are themselves methodologically significant. In his preliminary studies of the *endoxa*, I have argued, Aristotle both focuses his theoretical inquiry by refining why-questions, and directs his search for empirical data by noting failures and missed predictions of earlier scientists. Secondly, by placing emphasis on signs and proofs in the *Meteorology* subsequent to his actual definitions of phenomena, Aristotle invokes further explanations of relevant empirical data in arguing for the truth of his proposed scientific definitions.

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Appendix I: The Saltiness of the Sea

Aristotle takes up his examination of the sea in II, 3 and focuses mainly on why it is salty, a question he associates with issues about its origins and composition in general. He explores *endoxa* including Empedocles' claim that the sea is the sweat of the earth, and criticizes them (this one, by saying that it fails to explain, by not giving an account of "sweat"). Finally he moves to clear away these accounts and give his own, immediately alluding to his own assumption of the exhalations (357b24-26). He considers it "obvious" that the crucial factor will involve the dry exhalation. Next he notes various "signs" (*sēmeia*) that the sea's saltiness is due to some admixture. Two in particular are mentioned. In living bodies the least digested matter is salty and bitter; and, in combustion, ash remains. These are assimilated as both alike being cases where heat fails to master all its material. He remarks,

Just as in combustion there is a residue of earth of this kind, so there is in all natural growth and generation, and all exhalation on dry land is such a residue.

Dry land is such a residue, and it comprises most of the dry exhalation, which gets mixed with moist exhalation, turned into rain, and subsequently rained down and deposited in the sea. In crude syllogistic form we would express Aristotle's reasoning to his conclusion like this:

What includes a residue of the hot dry exhalation is salty.

The sea includes a residue of the hot dry exhalation.

The sea is salty.

Now, just as in his treatment of earthquakes, so here too does Aristotle proceed to lend support or credibility to his account by putting it to use in explaining associated phenomena (*sumbainonta*). First he explains why "rains from the south and the first rains of autumn are brackish." He next accounts for why the sea is warm and for why it never dries up. In addition, within this discussion he refers to a variety of homespun experiments all designed to prove his point, that the sea's saltiness is due to an admixture, one which fails to be present in any vapor formed over the sea. He notes that, first, with wine and other "tasty liquids" (*khumoi*), any evaporation simply becomes water on condensation. Next he describes an experiment where a bottle with a wax stopper thrown into the sea lets in only pure fresh water, "for the earthy substance whose admixture caused the saltiness is separated off as though in a filter." Furthermore, he cites it as a "proof" (*tekmerion*) that water's density becomes greater through admixture that eggs will float in very salty water (just as bodies float in the Dead Sea.) Each of these simple experiments is cited in an

effort to show that the cause of the sea's saltiness is what he says it is, an admixture of the hot dry exhalation. How would they do this? Presumably by showing that in other similar circumstances phenomena occur which are like those features or *sumbainonta* of the sea. For example, the fact that even heavy boats will float in the sea is taken to be another interesting *pathos* concerning the sea, and one which (I think) Aristotle regards as another sign that the sea's saltiness is due to an admixture; as evidence he reminds us that such a mixture serves to float eggs, on a smaller scale.

Appendix II: An Anomalous Methodological Remark

A very important — though frustratingly brief — methodological remark occurs within Aristotle's discussion of comets, where he seems to present an antirealist position. Here Aristotle suggests that there are varying degrees of testability and, perhaps, also of confirmability within a science like the *Meteorology*. He says,

We consider that we have given a sufficiently rational explanation of things inaccessible to observation by our senses if we have produced a theory that is possible: and the following seems, on the evidence available, to be the explanation of the phenomena now under consideration. (344a5-8)

Which things exactly are "inaccessible to observation" (*aphanōn tēi aisthē-sei*)? The cautionary remark is made only here; it may be that Aristotle intends it to apply primarily to heavenly phenomena, as opposed to those in and above the surface of the earth. At any rate, he does not hesitate to argue that various of his own proposals are correct; above I have examined his employment of various "signs" or "proofs" (*sēmeia* or *tekmēria*) for the correctness of his causal stories. Since he even makes such a claim for his proposed account of comets, it is hard to see what the impact is of the qualification made in the passage quoted just above. I am tempted, though without any further justification, to regard it as an interpolation (and one which is Epicurean in tone).⁴⁹

(49) See Sedley on Epicurus' views about the equal plausibility of all theories of celestial phenomena which are consistent with the phenomena (Sedley [1982], esp. pp. 268-72).

ARISTOTLE'S *DE CAELO* I 12 AND HIS NOTION OF POSSIBILITY

MARIO MIGNUCCI

I

The problems raised by *Cael.* I 12 are well known to Aristotle scholars and despite the numerous papers devoted to it there is no substantial agreement on its interpretation. Although it may appear boring to continue an endless debate, this Aristotelian chapter is so important for its logical and philosophical implications that a reader feels compelled to come back to the old story and make his own judgment. To underline the relevance of the logical problems involved it is sufficient to remember that our chapter is one of the pillars on which the so called "statistical interpretation" of modal operators proposed by Jaakko Hintikka is based.¹ As is known, according to Hintikka, Aristotle would have maintained a view here and elsewhere according to which a proposition *p* is necessary if and only if it is always true. Of course, one side of this equivalence is quite plausible, i.e.

$$(LA) \quad Lp \Rightarrow \forall t p(t)$$

I take "*p(t)*" to mean that *p* is the case at *t*. The difficult side is its converse, i.e.

$$(AL) \quad \forall t p(t) \Rightarrow Lp$$

Needless to say, holding (LA) and (AL) is the same as asserting

$$(LS) \quad Lp \Leftrightarrow \forall t p(t)$$

(1) Cf. J. Hintikka, *Time and Necessity. Studies in Aristotle's Theory of Modality*, Oxford: Clarendon Press, 1973, pp. 93-113; 151-152.

and this allows us to characterize possibility by means of the following equivalence:

$$(MS) \quad Mp \Leftrightarrow \exists t p(t)$$

I would not like to discuss the general question of whether or not Aristotle ever defended (MS). Such a general question is difficult to answer and would involve an examination of many controversial passages which are connected with very complicated historical and philosophical questions. Nobody should expect that this interconnected nest of questions could be even briefly answered in one paper. Let us take a more modest stance and claim that there is no reason to suppose that anything like (MS) is stated or logically implied by Aristotle in *Cael.* I 12. That is precisely what I would like to show by inspecting the first part of our chapter.

II

The general thesis of the chapter is well known and represents Aristotle's answer to the cosmological view expressed by Plato in the *Timaeus*. Needless to say, Plato's position was that the *kosmos*, the world, cannot be destroyed, although it has been generated. This is at least Aristotle's interpretation of Plato and we know that this interpretation was not shared by many distinguished Platonists even in ancient times.² Examining how reliable Aristotle's interpretation is does not concern us here. His view is that the world is eternal and it cannot be generated or destroyed. For our purposes it is important to consider the first step of his argument in favour of his claim, which is directed to show that whatever is eternal cannot have the possibility of being corrupted.

The proof of this thesis is contained in the first part of the chapter and we have to examine it carefully. Let us start by looking at the beginning:

(A) (a) Having established these distinctions we can now proceed to the sequel. (b) If there are some things which can both be and not be, (c) there must be some definite maximum time of their being and of not being; (d) a time, I mean, during which the thing can be and a time during which it can fail to be according to any category, whether the thing is, for example, a man, or white, or three cubits long, or whatever it may be. (e) For if the time is not definite in quantity, but always longer than any given time and shorter than none, (f) one and the same thing will be able to be for an infinite time and not to be for another infinite time. (g) This however is impossible.³

(2) A discussion of this problem can be found in II. Cherniss, *Aristotle's Criticism of Plato and the Academy*, I, New York: Russell & Russell, 1962², p. 421 ff.

(3) *Cael.* I 12, 281a28-b2 (revised Oxford translation slightly modified).

Before trying to understand Aristotle's move, some preliminary remarks must be made. First of all, it must be pointed out that the temporal restriction which is hinted at in (c) and (d) has to be taken as a restriction on the possibility of being or not being or being such and not being such, and not as a limitation on a subject's having this possibility. If *a* has the possibility of eating and not eating, what Aristotle claims is not that *a* has only some of the time this possibility, but that this possibility cannot be a possibility of always eating and always not eating. This point has been convincingly made by Lindsay Judson in his valuable paper on this subject and I do not need to repeat his argument.⁴

We have to establish the meaning of "ἐνία δυνατόν καὶ εἶναι καὶ μὴ" in (b). Several problems are interwoven. First of all, does "δυνατόν" refer to possibilities or capacities? This question can reasonably be proposed only if a distinction between "capacity" and "possibility" is at work. Suppose that any capacity implies a possibility and that the converse does not hold. If this is true, I do not see any reason to restrict Aristotle's reasoning to capacities. In what follows he discusses the case of something which may not be. It seems slightly odd to interpret this as a statement that something has the capacity not to be. And it is even stranger to speak of the *capacity* of being three cubits long, while it is much more natural to say that something is *possibly* three cubits long. But one might reply that there are contexts in which it may not be strange to say that something is *capable* of being three cubits long. However, what is relevant is that Aristotle does not speak of the *δύναμις* to be as opposed to the *δύναμις* not to be. He makes his point about what is *δυνατόν* to be and not to be, and it appears natural to me to interpret it as a statement about what *can* be and not be. We will return to this question later on. Besides, it does not seem to me that Aristotle normally makes a clear cut distinction between the two notions. The attitude he takes in *Melaph.* Θ 3 is in my view paradigmatic. He starts by considering possibilities which are capacities, such as the capacity of building.⁵ After a while he slips more or less tacitly into a notion of possibility which we would be inclined to represent by means of the familiar modal operator⁶ and he ends his

(4) Cf. L. Judson, "Eternity and Necessity in *De Caelo* I 12. A discussion of Sarah Waterlow, *Passage and Possibility: A Study of Aristotle's Modal Concepts*", *Oxford Studies in Ancient Philosophy*, I (1983), pp. 226-227. The best evidence for this claim is offered by the discussion of capacities at *Cael.* I 11, 281a7 ff. A similar point is made also by C. Campus & M. Mariani, "Il principio di pienezza in 'Met'. Θ 4 e 'De Coelo' A 12", *Teoria* 6 (1986), p. 185.

(5) Cf. *Melaph.* Θ 3, 1046b29-1047a10.

(6) *Melaph.* Θ 3, 1047a10-14.

discussion of the Megaric position by a definition of possibility which is his usual general definition of possibility.⁷ Therefore, although his examples of *δυνάμεις* at *Cael.* I 11, 281a7ff. seem to apply better to capacities than possibilities, it does not follow from this that his point is restricted to mere capacities and does not include general possibilities. On the other hand, immediately after the passage we have just quoted Aristotle offers a kind of digression in which some usual modal distinctions and theses are stated. He reminds us that impossibility, possibility, truth and falsity *ἐξ ὑποθέσεως* must be distinguished from the corresponding absolute notions.⁸ Even if his illustration of the distinction is far from clear,⁹ there is no doubt that a modal doctrine is hinted at which is familiar to any reader of the *Corpus*. For instance, Aristotle distinguishes repeatedly what is *ἀναγκαῖον ἐξ ὑποθέσεως* from what is *ἀπλῶς ἀναγκαῖον*.¹⁰ Besides, with respect to what is false or impossible in an absolute way he underlines that we have to separate clearly the two notions: to say that I am standing when I am sitting is simply false but not impossible; on the other hand, the statement that the diagonal of a square is commensurable with a side is not only false but also simply impossible.¹¹ Finally, a modal thesis is mentioned which can be found elsewhere in an equivalent form,¹² namely the thesis that if *B* follows from *A*, and *A* is impossible, *B* is impossible too.¹³ All this makes it plausible that the *δυνατά* of which Aristotle is speaking are just possible states of affairs, which can adequately be expressed by propositions modally qualified by the operator of possibility.

Aristotle is then speaking of the *possibility* of being and not being. This possibility of being and not being is in my view a possibility of existing and of not existing. Since it must be temporally limited, the existence which Aristotle has in mind is a temporal existence, which is different from purely logical existence. We can represent the latter by stating *à la Quine* that *a* exists if and only if *a* is something which belongs to our universe of discourse, that is if and only if

$$(1) \quad \exists x(x = a)$$

holds. On the other hand, temporal existence refers to *a*'s existing in

(7) *Metaph.* Θ 3, 1047a24ff.

(8) *Cael.* I 12, 281b2-8.

(9) For instance that the diagonal of a square is commensurable with the side is quoted as an example of impossibility *ἐξ ὑποθέσεως* at 281b6, while it is taken as an instance of *ἀπλῶς ἀναγκαῖον* few lines after (281b12-13).

(10) E.g. *Ph* II 9, 199b34ff and H. Bonitz, *Index Aristotelicus*, Graz: Akademische Druck- u. Verlagsanstalt, 1955², 42b10ff.

(11) *Cael.* I 12, 281b6-14.

(12) Cf. *Metaph.* Θ 4, 1047b14-26; *APr.* I 15, 34a5-33.

(13) *Cael.* I 12, 281b15.

an interval of time. We may express this by means of a dyadic predicate "*E!(x, y)*", so that we can state e.g.

$$(2) \quad E!(a, j)$$

to say that *a* exists at *j* or in the interval *j*. It is important to notice that Aristotle in (d) extends his point about the possibility of existing and of not existing to any kind of phasal predicate. We have to put a temporal limit not only to the possibility of existing and not existing but to any possibility of being such and not such.¹⁴ If this is true, we must be prepared to admit that Aristotle's claim covers any possible state of affairs, and not just the possibility of existing and not existing. For any state of affairs of which the possibility of both its taking place and not taking place is asserted we have to introduce a temporal restriction.

Let us further delay the analysis of Aristotle's argument by trying to answer a further question. If "*δυνατά*" implies a reference to a modal operator, how should we conceive of it? There are *prima facie* two ways of interpreting the notion of possibility involved. One is by taking it as expressing what is normally called "strict" or "open possibility". As is known, the standard notion of possibility is opposed to impossibility, but it does not rule out necessity. Let us call this possibility "broad possibility" and represent it by "*M*". Aristotle sometimes takes possibility in a stricter sense by opposing it not only to impossibility, but also to necessity. In other words, *p* is strictly possible, i.e. *Ep*, if and only if *p* is *M*-possible and $\neg p$ is *M*-possible.¹⁵ We have formally

$$(ED) \quad Ep \Leftrightarrow Mp \wedge M\neg p$$

(14) Sarah Waterlow's claim that Aristotle's thesis is limited here to predicates which fall in one of the categories has no support in the text (cf. S. Waterlow, *Passage and Possibility. A Study of Aristotle's Modal Concepts*, Oxford: Clarendon Press, 1982, pp. 58-61). "*Καθ' ὅποιον κατηγορίαν*" does not mean "according to any category", but "according to any predication" or "predicate". Another criticism of Waterlow's claim can be found in Judson, pp. 222-224.

(15) This way of conceiving possibility is reflected for instance in the definition of *ἐνδεχόμενον* at *APr.* I 13, 32a18-20. The distinction between *E* - and *M* - possibility is widely acknowledged in the modern literature on Aristotle. Cf. e.g. A. Becker, *Die aristotelische Theorie der Möglichkeitschlüsse*, Berlin: Junker und Dünhaupt Verlag, 1933, pp. 7-11; I. M. Bochenski, *La logique de Théophraste*, Fribourg en Suisse: Librairie de l'Université, 1947, pp. 68-69; D. Ross, *Aristotle's Prior and Posterior Analytics, A Revised Text with Introduction and Commentary*, Oxford: Clarendon Press, 1949, p. 327; J. Lukasiewicz, *Aristotle's Syllogistic from the Standpoint of Modern Formal Logic*, Oxford: Clarendon Press, 1957², p. 191; S. MacCall, *Aristotle's Modal Syllogisms*, Amsterdam: North Holland, 1963, pp. 66-70; Hintikka, pp. 27-31; G. Granger, *La théorie aristotélécienne de la science*, Paris: Aubier, 1976, pp. 179-182; U. Wolf, *Möglichkeit und Notwendigkeit bei Aristoteles und heute*, München: Fink, 1979, p. 102; G. Seel, *Die Aristotelische Modaltheorie*, Berlin: de Gruyter, 1982, pp. 158-160; Waterlow, pp. 16-17.

It is clear that it cannot be this kind of possibility which is in question in our passage. There is no contradiction in supposing that it is possible that a state of affairs takes place for an indefinite time and that it is possible for its opposite to take place indefinitely.

The possibility which is at issue here is something different and it concerns the possibility of a state of affairs and its opposite's taking place. The point is made by Aristotle very clearly in the following of the chapter, when he comments on the main thesis of (A). He says:

(B) A man has, it is true, the possibility at once of sitting and standing, because when he possesses the one he also possesses the other; but it does not follow that he can at the same time sit and stand, but at different times. But if a thing has for infinite time more than one possibility,¹⁶ another time is impossible and the times must coincide.¹⁷

Aristotle's claim is simple. Suppose that we have two states of affairs represented by the following propositions:

(i) Socrates is sitting

and

(ii) Socrates is standing

It is surely possible for Socrates to sit and to stand, but not at the same time. With respect to (i) and (ii) it is easy to express Aristotle's point by imagining that (i) and (ii) are implicitly tensed and by stating that it cannot be possible that they are both true if they refer to the same time. Therefore, let " $p(j)$ " be "Socrates is sitting at j " and " $q(k)$ " "Socrates is standing at k ". A necessary condition for the truth of

(3) $M(p(j) \wedge q(k))$

is that j is different from k , since

(4) $\neg M(p(j) \wedge q(j))$

surely holds for any j .¹⁸

We are now in a position to understand Aristotle's main thesis in text (B). If we are dealing with propositions such as (i) or (ii) (or perhaps better with the states of affairs denoted by such propositions) we cannot take $p(t)$ as referring to an indefinite time or, which is the same, to any time. In other words, suppose that we have two propositions $p(t)$ and $q(t)$ which are inconsistent in the sense that they

(16) As Judson, p. 229 has nicely remarked, Aristotle's way of speaking is infelicitous here, because it gives the impression that we have to do not with a capacity of doing something for ever, but with the eternal possession of a capacity of doing.

(17) *Cael.* I 12, 281a15-19 (revised Oxford translation slightly modified).

(18) That $\neg(j = k)$ is just a necessary condition for the truth of (3) can be seen by reflecting that (3) is false if an impossible proposition is substituted for p or q .

satisfy (4). To take them without any temporal limitation means to state $\forall tp(t)$ and $\forall tq(t)$. It is obvious that

(T) $\neg M(\forall tp(t) \wedge \forall tq(t))$

holds. The same is true if we take as " q " the negation of p , since

(T₁) $\neg M(\forall tp(t) \wedge \forall t\neg p(t))$

is surely a perfectly safe law of standard modal logic, since the set of instants or intervals of time t is supposed not to be empty by hypothesis.

If this interpretation is correct, there is no reason to endorse Lindsay Judson's daring view, according to which the *δυνάμεις* which Aristotle is considering here are the capacities of the eternal elements which constitute the cosmos by their ordered arrangement. His reasoning is as follows:

If a thing has the capacity to exist for a limited time only, then how can its capacity for *non-existence* be for a limited time also? What does the thing do when both its capacities have been fully exercised?¹⁹

From this remark Judson concludes that in Aristotle's passage eternal but non perishable individuals are at issue, and they must be the cosmic elements.²⁰ Against this argument an objection can be raised. Aristotle does not claim that the capacity of being is opposed to the capacity of not being. That of which is speaking is the possibility of being and not being. It is not the capacity of Socrates' sitting against his capacity of standing which is in question here. It is his possibility of both standing and sitting at the same time which is denied. Therefore, our text does not rule out that there is a capacity or possibility of indefinitely not being. What it *does* dismiss is that there is at the same time a possibility of being *and* not being for an indefinite time. To put it in terms of capacities, our text just excludes that it is possible for a thing to exercise for an indefinite time one capacity and its opposite. And of course this applies not only to eternal, but also to contingent things.²¹

III

So far so good. The difficult part of Aristotle's reasoning is the application of (T₁) which is made by him to show that what is eternal is not destructible. The essential part of his argument is contained in the following passage:

(19) Cf. Judson, p. 226.

(20) Cf. Judson, pp. 226-227.

(21) For a different criticism of Judson's position see Campus-Mariani, pp. 185-186.

(C) (a) Thus if anything which exists for infinite time is destructible, it will have the possibility of not being. (b) Now if it exists for infinite time let its possibility be actualized; (c) and it will be in actuality at once existent and non-existent. (d) Thus a false conclusion would follow because a false assumption was made; (e) but if what was assumed had not been impossible its consequence would not have been impossible.²²

The argument starts with a conditional whose ground is offered by the discussion of the uses of "indestructible" and its opposite "destructible" put forward in the previous chapter. The proper definition of "destructible" is the following:

(D) (a) The uses of the words "destructible" and "indestructible" are similar. (b) "Destructible" is applied to that which formerly was and afterwards either is not or might not be whether a destruction and change intervene or not at some time. (c) In some cases we call "destructible" that which may not be because of a process of destruction. (d) Besides, we call "destructible" that which is easily destructible, the "easily-destroyed" so to speak.²³

It is clear that the sense of "destructible" which is in question in text (C) is what is described by clause (b). This is confirmed by Aristotle himself who recalls definition (b) a few lines after the passage quoted in (C) at *Cael.* I 12, 281b27-28. I take the disjunctive characterization of "destructible" in (b) as a proper disjunction: a is destructible if and only if a exists at t and either (i) there is a time t' such that $t < t'$ and a does not exist at t' or (ii) it is possible that there is a time $t' > t$ in which a does not exist at t' . In this view the fulfillment of condition (ii) is sufficient to call something destructible.

Let me insist on this point. In (b) Aristotle explicitly states that actual destruction is not necessary to qualify something as destructible. Besides, he underlines that an essential reference to impossibility is contained in the proper meaning of "indestructible"; the reason why a thing is properly called "indestructible" is that it *cannot* undergo destruction.²⁴ Finally, if something were destructible only if it is destroyed at some time, the whole argument of text (C) would be trivial. If a is eternal, i.e. always exists, a is indestructible, because it does not undergo destruction at some time *ex hypothesi*. What makes Aristotle's argument non-trivial (although wrong) is precisely the idea that a thing can be truly said to be destructible even if it is never destroyed. The statistical interpretation of the modal operators seems to be far removed from Aristotle's present way of putting things.

However, let us return to text (C) and to Aristotle's proof that what is eternal is indestructible. To say that a is eternal amounts to stating

(22) *Cael.* I 12, 281b20-25 (revised Oxford translation slightly modified).

(23) *Cael.* I 11, 280b20-25 (revised Oxford translation slightly modified).

(24) Cf. *Cael.* I 11, 281a1-4. I do not see how Hintikka, p. 151 note 9 and p. 102 can claim that a purely temporal characterization of "indestructible" is given by Aristotle.

that a always exists and we can represent it by $\forall t E!(a, t)$. To express destructibility is slightly more complicated because we need something like

$$(DD) \quad D(a) \text{ iff } \exists t (E!(a, t) \wedge M \exists t' (t < t' \wedge \neg E!(a, t'))^{25}$$

where, of course, " $D(x)$ " stands for " x is destructible". Therefore, the main thesis of Aristotle in (C) can be expressed by

$$(MT^*) \quad \forall t E!(a, t) \Rightarrow \neg (\exists t (E!(a, t) \wedge M \exists t' (t < t' \wedge \neg E!(a, t')))$$

As (a) clearly suggests, (MT*) can be simplified to

$$(MT) \quad \forall t E!(a, t) \Rightarrow \neg M \exists t \neg E!(a, t)$$

since (MT) implies (MT*).

The proof of (MT) is by *reductio ad absurdum*. This means that we to suppose that the negation of (MT) is true, i.e.

$$(5) \quad \forall t E!(a, t) \wedge M \exists t \neg E!(a, t)$$

In (b) a further assumption is made, i.e. that the capacity of a is actualized. I take it to mean that the possibility for non-existence of a is supposed to be realized, i.e. that a certain time a does not exist. We will evaluate this move later on. Suppose then that $\exists t \neg E!(a, t)$ is the case. With respect to it Aristotle rightly points out that it cannot be true together with $\forall t E!(a, t)$. In fact we have

$$(6) \quad \neg M (\forall t E!(a, t) \wedge \exists t \neg E!(a, t))$$

as a special case of (T₁). Therefore — this is Aristotle's conclusion — since we have reached something absurd from supposing that a sometimes does not exist, $\exists t \neg E!(a, t)$ cannot be possible. Thus, if a is eternal, there cannot be a time in which a does not exist, and this means that a is indestructible. This conclusion must carefully be examined, since it is far from obvious. (6) is not the negation of (5) and Aristotle develops an argument in order to go from (6), which is indisputable, to the negation of (5). This argument is based on the idea that it is not sufficient to say that $\neg E!(a, t)$ is false, but it must be added that it is impossible, since it yields a contradiction.

A possible way to explain Aristotle's move is by supposing that

(25) Susanne Bobzien has suggested to me that it would be better to put the modal operator after the temporal quantifier, since the possibility of time is not in question here. But if time is supposed to be one and the same in the different counterfactual situations with respect to which we evaluate modal propositions, we can think of it as a set of instants or intervals which is one and the same in different possible worlds. If so, something similar to the well known "Barcan formula" can be assumed, which allows us to reverse the order of the existential quantifier over time intervals or instants and the modal operator of possibility. I prefix the modal operator to the existential quantifier for technical reasons.

when he says that $\exists t \neg E!(a, t)$ is possible, he implies that his actualization is consistent with whatever is supposed to be true. In other words, Aristotle's view seems to be that if A is true and B is possible, then B can be true together with A . Let us therefore state as a general law

$$(R) \quad A \wedge MB \Rightarrow M(A \wedge B)$$

By applying (R) to our case we get

$$(7) \quad \forall t E!(a, t) \wedge M \exists t \neg E!(a, t) \Rightarrow M(\forall t E!(a, t) \wedge \exists t \neg E!(a, t))$$

Since the consequent of (7) is the negation of (6) we can immediately derive by contraposition the negation of its antecedent, i.e. the negation of (5). Therefore, we are entitled to assert (MT) and consequently (MT*).

Interpreted in this way, the whole of Aristotle's proof depends on (R). Unfortunately, (R) is invalid, as is easy to see.²⁶ Therefore, Aristotle's argument is incorrect and it does not prove (MT). And we have to expect this, since (MT) is obviously false. Aristotle's wrong idea depends on supposing that if something is possible, it must be possible in such a way that it is consistent with everything which is the case.

IV

Insisting on underlining the fallacy of Aristotle's argument does not matter. It is more important to stress that in the reconstruction which we have made there is no need to resort to Hintikka's statistical interpretation of modalities. One might object to this conclusion as follows: all right, by interpreting Aristotle's argument in this way the statistical interpretation does not play any role. But the price we have to pay for such a manoeuvre is that we are compelled to attribute a fallacy to Aristotle. This charge would be avoided if the statistical interpretation were admitted. Therefore, by the charity principle we must prefer the statistical interpretation.

I believe that the charity principle must be adopted in reading ancient texts, but it cannot have as a consequence a distortion of the historical facts. In my view the interpretation which I have proposed is demanded and the statistical interpretation ruled out by the texts. Let us return to text (C) and point out that Aristotle in (d) qualifies as *false* the assumption made. More precisely, he says that this assumption is not only false, but also impossible, since it yields a

(26) To see this it is sufficient to substitute " $\neg A$ " for " B " in (R). There is surely a case in which A is true together with its possibility of being false. But it cannot be true that A is true together with its negation.

contradiction. It seems inevitable to conclude that the false assumption of which Aristotle is speaking is that a sometimes does not exist, i.e. $\exists t \neg E!(a, t)$. In what sense is this proposition false? A natural answer is that $\exists t \neg E!(a, t)$ is qualified as false because it does not follow from $M \exists t \neg E!(a, t)$. This way of speaking is quite common in Aristotle and several passages can be quoted where the same point is made — for instance at *APr.* I 15, 34a37-38, where a similar argument is proposed in order to justify *Barbara XEM*,²⁷ as we will see in detail later on.²⁸

Suppose now that the statistical interpretation holds. Possibility must be defined according to (MS) and this means that it must be eliminated in favour of an existential quantification on the instants or intervals of time. From this point of view an implication such as

$$(8) \quad M \exists t \neg E!(a, t) \Rightarrow \exists t \neg E!(a, t)$$

would be perfectly all right and there would be no reason for Aristotle to say that $\exists t \neg E!(a, t)$ is false if he had shared the statistical interpretation of modalities.²⁹

Besides, what we have already hinted at must be underlined. The possibility which plays a role in the definition of "destructible" can hardly be reduced to its temporal interpretation. Aristotle clearly says that a thing is destructible independently of the fact that it undergoes a destruction. But in a temporal perspective if a is never destroyed it cannot be said to preserve its possibility of being destroyed.

Finally, the statistical interpretation is strongly reductionist as far as modalities are concerned. Modal operators are simply replaced by quantifiers over instants or intervals of time. In this frame the thesis according to which what is eternal is indestructible becomes trivial and one can hardly understand why Aristotle presents so elaborate an argument in order to prove simply that if a always exists there is no time in which it does not exist.

However, a defender of the temporal reading of modalities might insist on his view. Nobody can deny that Aristotle asserts (MT). (MT) can easily be generalized to

$$(MT_G) \quad \forall t p(t) \Rightarrow L \forall t p(t)$$

(27) "*Barbara XEM*" means "*Barbara* with a categorical major and strictly possible minor premiss and broadly possible conclusion".

(28) It must be pointed out that the interpretation of "false" I am illustrating here was first proposed by D. Ross, pp. 338-339.

(29) I do not understand how Hintikka, p. 190 can claim that *APr.* I 15, 34a37-38 just quoted is a piece of evidence for his temporal interpretation of modalities. By assuming that "it is possible for B to apply to all C " Aristotle is not committed to the view that "at some moment of time it is therefore true to say ' B applies to all C '". If this was his positions, why should he have qualified this latter proposition as false?

since the same reasoning which gives (MT) can be applied to any proposition which is the case at any time. And, of course, (MT_G) is a special case of (LA) which is the difficult side of the statistical characterization of necessity. Therefore, Aristotle in the *De Caelo* passage endorses a temporal view of modalities.

Well, it cannot be denied that Aristotle by asserting (MT) implicitly states (MT_G) and therefore some form of a temporal interpretation of necessity. The situation is however quite different from the way in which Hintikka portrays it. He claims that Aristotle's asserting (MT) in the *De Caelo* is a consequence of his general view about modalities. On Hintikka's account, since Aristotle identifies "necessary" with "always true", he draws the consequence that whatever always exists it is so necessarily. In my interpretation Aristotle's conclusion is not a consequence of a general view about modalities, but the result of a mistake about the laws of distribution of possibility. This means that (MT) is not a thesis of a consistent theory of modalities, but a *non-sequitur*, i.e. a proposition which he would not have asserted if he had been consistent in his views about modalities. Therefore, (MT) does not hint at an alternative conception of the modal notions, but simply shows how is easy to get mistaken when modalities are in question.

V

I hope that the interpretation I have proposed is plausible. If we accept it however, we have to charge Aristotle with a modal fallacy. And of course Aristotle's partisans might find this view quite repellent. Not just to soften their reaction, but to insist on the obvious observation that we must read Aristotle, like any other philosopher, without prejudices, it must be pointed out that there are other passages in which Aristotle is guilty of the same logical mistake we have attributed to him in *De Caelo* I 12.

Let us consider *APr.* I 15, 34b19-27. In this chapter Aristotle considers first figure modal syllogisms which have one categorical and one possible premiss. The passage which interests us concerns *Celarent* with categorical major and possible minor. Aristotle's claim is that its conclusion is a *M*-possible proposition. Therefore, he believes that *Celarent XEM* holds good.³⁰ His argument is the following:

(E) (a) Again let the proposition *AB* be universal and negative, and assume that *A* belongs to no *B*, but *B* possibly belongs to every *C*. These being laid down, it is necessary that *A* possibly belongs to no *C*. (b) Suppose

(30) As usual, "X" indicates that the major premiss of *Celarent* is a categorical proposition, "E" that its minor premiss is strictly possible and "M" that the conclusion is possible in a broad sense.

that it cannot belong, (c) and that *B* belongs to *C*, as above.³¹ (d) It is necessary then that *A* belongs to some *B*; for we have a syllogism in the third figure. (e) But this is impossible. Thus it will be possible for *A* to belong to no *C*; for the consequence of a false assumption is impossible (*APr.* I 15, 34b19-27; revised Oxford translation slightly modified).

Sentence (a) reports the thesis which Aristotle wants to prove, i.e. *Celarent XEM*, and we can express it by

$$(CX) \quad AeB \wedge EBaC \Rightarrow MAeC$$

As (b) clearly shows, Aristotle's argument is by *reductio*. Suppose then that (CX) does not hold. In at least one case it happens that the premisses of (CX) are true together with the negation of its conclusion, i.e.

$$(9) \quad AeB \wedge EBaC \wedge LAiC$$

By substituting *BaC* for *EBaC* Aristotle construes the following third figure syllogism:

$$(DL) \quad LAiC \wedge BaC \Rightarrow AiB$$

which is acknowledged by him as valid.³² From it

$$(10) \quad \neg M(AeB \wedge BaC \wedge LAiC)$$

follows immediately, if we admit a sort of necessitation rule.³³ Of course, (10) is not the negation of (9) and what we need to prove (CX) is not (10) but the negation of (9). Clause (e) is supposed to provide a way to pass from (10) to the denial of (9). If we resort once more to (R) we have an easy bridge to (9). Since

$$(11) \quad Ep \Rightarrow Mp$$

holds in general, from the hypothesis that *BaC* is strictly possible, i.e. *EBaC*, we derive that it is simply possible, i.e. *MBaC*. Therefore, if (9) holds, we may assert also

$$(12) \quad AeB \wedge MBaC \wedge LAiC$$

By applying (R) we get

$$(13) \quad AeB \wedge MBaC \wedge LAiC \Rightarrow M(AeB \wedge BaC \wedge LAiC)$$

Of course, the consequent of (13) is the negation of (10). Therefore, we can state

$$(14) \quad \neg(AeB \wedge MBaC \wedge LAiC)$$

(31) Aristotle is here referring to the proof of *Barbara XEM* which is expounded at 34a34-b6 and uses the same device as the one for *Celarent XEM*.

(32) Cf. *APr.* I II, 31b31-33.

(33) We can alternatively take (DL) as a necessary implication, as ἀναγκαῖα at 34b23 allows us to admit. In this case (9) should be prefixed by a possibility operator. The argument however does not change.

From (14) we derive immediately

$$(15) \quad \neg(AeB \wedge EBaC \wedge LAiC)$$

and this completes the proof of (CX).

Once again (R) plays a role in an Aristotelian demonstration and once again we have to repeat that it is an invalid principle. And in fact (CX) does not hold.³⁴ The same situation takes place with respect to the proof of *Barbara XEM*, where a similar argument is used. Reporting the proof in detail does not matter, since it is parallel to the proof of *Celarent XEM* we have already examined.³⁵

If I may venture a conclusion in this complicated matter, I am inclined to say that *De Caelo* I 12 as well as *APr.* I 15 do not offer any new hint at a different analysis of modal notions on the part of Aristotle, but simply show how even as great a logician as he was can be trapped in the snares of modalities. And there is nothing exciting in all this.

(34) Ross, pp. 339 and 341 thinks that Aristotle's argument for (CX) is correct, but he is surely wrong and we must endorse Becker's and Tredennick's view in denying its validity. Cf. Becker, pp. 52-54 and Aristotle, *Prior Analytics*, by H. Tredennick, London: Heinemann, 1938, p. 270 note d.

(35) Cf. *APr.* I 15, 34a34-b2.

BIPARTITE SCIENCE IN ARISTOTLE'S BIOLOGY

WOLFGANG KULLMANN

The conception of a bipartite science (ἐπὶ τὰς ἀρχάς — ἀπὸ τῶν ἀρχῶν, φαινόμενα — αἰτίαι, ὅτι — διότι) is a subject with which I have dealt at some length in my book *Wissenschaft und Methode*.¹ Now it is my intention to reconsider this conception from a more general point of view.

In modern times we often describe the method of science as a bipartite procedure consisting of induction and deduction. The first one is usually considered as an empirical approach which leads from the particular to the universal, the latter one as a procedure which — starting from the universal — arrives at derived propositions. I leave out of account the further import of this distinction in modern times.

The beginnings of this differentiation can be found in Plato. In the Platonic dialogues the pedagogically leading part, normally Socrates, tries to lead someone to new insights. The starting-point is the ὁμολογία, the agreement between both of the interlocutors. As a rule Socrates is leading his vis-à-vis to the insight that his knowledge is based upon hypotheses and that it is necessary to ascend to more and more general hypotheses and at last to a highest, the ἀνυπόθετον. The cognition of this ἀνυπόθετον enables him to descend into the area of the ideas, however this descent may be conceived in detail.

As early as in the *Topics* Aristotle presents the matter in a more abstract way.² He reflects upon the character of homology.

(1) W. Kullmann, *Wissenschaft und Methode. Interpretationen zur aristotelischen Theorie der Naturwissenschaft*, Berlin-New York (de Gruyter) 1974, ch. III: Phänomenologie und Ätiologie, p. 154-268.

(2) W. Kullmann, *Wissenschaft und Methode* (see above n. 1) 165ff.

According to his view homology should be based upon an *ἐνδοξον*, i.e. something which seems to be so to all men, to most men or to the wise men. It belongs to the tasks of dialectics, which is starting from *ἐνδοξα*, to guide to the *ἀρχαί* of the sciences (I 2.101 a 36ff.). This means, it is no longer Socrates who is leading someone to the *ἀρχή ἀνυπόθετος*. On the other side the different *epistēmai* start from the *ἀρχαί* and arrive at new conclusions. Now Aristotle realizes that *ἐπαγωγή*, originally the leading of a pupil to the universal and the true,³ has something to do with perception. "Induction" is, he says, in comparison with syllogism, *κατὰ τὴν αἰσθησιν γνωριμώτερον*, more knowable according to perception (I 12.105 a 17), though perception is not its decisive presupposition.

Aristotle silently changes his view when he comes to his theory of apodeixis in the *Anal. post.*⁴ He does not explicitly revoke his former opinion concerning the rôle played by dialectics; but it becomes clear that he no longer confines science (as it might seem at first sight) to the apodeictic syllogism which proceeds from first propositions, i.e. from principles of proof. Chapters I 16-18, for example, deal with the question in which cases the result of syllogistic *apodeixis* is faulty. Aristotle here expressly acknowledges that demonstration depends on *epagoge*, i.e. on the leading to the universal, and that *epagoge* itself presupposes perception. The terminology has become more abstract; the concepts used in this connection are no longer related to persons as they were in Plato and in the Aristotle of the *Topics*. There is no question of agreement between interlocutors, of guiding some pupil to the universal, nor of what seems to be right to anybody. Dialectics has obviously lost its auxiliary function of guiding to the first principles of the sciences. One can only be conducted to them by means of perception (I 18.81 b 5 *ἐπαχθῆναι*), not by means of *δόξαι*, which are the starting-points of dialectics.

In this respect chapter I 13 is of special importance.⁵ Here Aristotle investigates the difference between the knowledge of the "that" and the knowledge of the "why" (cf. also I 27). He states that both types of knowledge are sometimes found within the same science and sometimes belong to different sciences. Aristotle elucidates the difference between the two types by pointing to the different forms of syllogism which they entail. The syllogism of the "that", i.e. the syllogism of fact, proceeds from what can be empirically observed (in 78a 34f. *epagoge* and perception are mentioned); the syllogism of the "why", however, proceeds from apodeictic principles, i.e. from immedia-

te premisses, especially from definitions or definitional propositions ("the planets are near").

Aristotle does obviously not mean to say that the *ἔτι*, i.e. that part of a science which is concerned with facts (provided that it is a science which contains facts as well as reasons) only consists in syllogisms. Among the cases in which the "that" and the "why" are divided among two sciences, an instructive example can be found which proves this point: According to 78b 35ff. the "phenomena" are separated from mathematical astronomy forming a special discipline subordinate to it. The passage is difficult. It is obvious, however, that the investigation of astronomical phenomena represents a discipline which is purely descriptive, a discipline, which collects facts concerning celestial bodies and is probably identical with "nautical" astronomy. Compare *Anal. pr.* I 30.46 a 17ff. where the same example occurs, although the term *ἔτι* is lacking:

"Therefore it is the task of experience to give the principles which belong to each subject. I mean for example that it is the task of astronomical experience to supply the principles of astronomical science (for it was not until the phenomena had been sufficiently apprehended that the astronomical demonstrations were discovered); and the same applies to any other art or science. So if the attributes of each thing are apprehended, it will be our task to exhibit readily the demonstrations. For if none of the true attributes of the things has been omitted in our inquiry, we shall be able to find out and to demonstrate everything which has a proof, and to make that clear whose nature does not admit of proof." (tr. Tredennick, Jenkinson, with changes)

διὸ τὰς μὲν ἀρχὰς τὰς περὶ ἕκαστον ἐμπειρίας ἐστὶ παραδοῦναι, λέγω δ' οἷον τὴν ἀστρολογικὴν μὲν ἐμπειρίαν τῆς ἀστρολογικῆς ἐπιστήμης (ληφθέντων γὰρ ἱκανῶς τῶν φαινομένων οὕτως εὐρέθησαν αἱ ἀστρολογικαὶ ἀποδείξεις), ὁμοίως δὲ καὶ περὶ ἄλλην ὁποιοῦν ἔχει τέχνην τε καὶ ἐπιστήμην· ὥστ' ἐὰν ληφθῇ τὰ ὑπάρχοντα περὶ ἕκαστον, ἡμέτερον ἤδη τὰς ἀποδείξεις ἐτοίμως ἐμφανίζειν. εἰ γὰρ μὴδὲν κατὰ τὴν ἱστορίαν παραλειφθεῖ τῶν ἀληθῶς ὑπαρχόντων τοῖς πράγμασιν, ἔξομεν περὶ ἅπαντος οὐ μὲν ἐστὶν ἀπόδειξις, ταύτην εὐρεῖν καὶ ἀποδεικνύναι, οὐ δὲ μὴ πέφυκεν ἀπόδειξις, τοῦτο ποιεῖν φανερόν.

In this passage Aristotle emphasizes the universality of the syllogistic method and goes into the preconditions for the application of this method. The *ἀρχαί*, he says, are supplied by *ἐμπειρία*. As an example he mentions astronomical *ἐμπειρία*, which supplies the *ἀρχαί* for the astronomical science. When the phenomena of the stars had been sufficiently collected, he points out in 46a 20ff., the astronomical proofs were discovered; the same applies to any other *technē* or science. Aristotle goes on by saying that as soon as the *ὑπάρχοντα*, i.e.

(3) Cf. E. Kapp, *Greek Foundations of Traditional Logic*, New York 1942, 75f. (= *Der Ursprung der Logik bei den Griechen*, Göttingen 1965, 89f.).

(4) W. Kullmann (see above n. 1) 169ff.

(5) W. Kullmann (see above n. 1) 206ff.

the properties of any one subject, are fully discovered, it is our task to produce the proofs. If in the course of our investigation (*ιστορία*) no true properties of the things have been left out, we are able to find a proof of everything which is provable, and to show what is improvable.

With regard to this passage some points should be stressed: Science is based on experience, not on opinions (*δόξα*). Experience supplies the facts, *υπάρχοντα*, i.e. properties which apply to the subjects of the sciences. These facts are also called *φαινόμενα*, particularly in the field of astronomy (which served as an example). From the fact that Aristotle used the example of astronomy, which surely does not interest him for its own sake,⁶ both in *Anal. post.* I 13 and in *Anal. pr.* I 30, it appears that he has another science in mind to which this theory can be applied, a science which is in a way similar to astronomy. As I have pointed out elsewhere,⁷ this must be biology. This is supported by the use of the term *ιστορία* which occurs in both fields. Besides, in *PA* I 1.639b 7ff., 640a 14f. the *φαινόμενα-αίτια*-model of astronomy is indeed transferred to biology. Another important point in *Anal. pr.* I 30 is that the astronomical model is also characterized by the terms *ἀρχαί-ἀπόδειξις*. So we find a combination of the ascent/descent-model and the "that"/"why"-model (or *φαινόμενα-αίτια*-model respectively).

This identification of the two models with each other poses questions. The way towards the principles is partly a way of generalization (*ἐπαγωγή*), partly a way from propositions which are general but remote from the principles, towards the principles. "ὅτι", that something is so and so, only refers to facts. Facts, however, are those propositions which serve as premisses and as such possibly as principles of proof in the scientific syllogism, as well as those propositions which there appear as conclusions. The predicate in these collected propositions may be either a specific difference or a *συμβεβηκός καὶ αὐτό*, i.e. a necessary, non-definitional property. It is obviously for this reason that Aristotle expresses himself somewhat more clearly at the end of the passage, after having spoken of the finding of principles at the beginning: If in the investigation none of the properties which really belong to the things have been left out, we are able to find a proof of those things of which a proof is possible, and to show of which things there is no proof. This means that the collection of facts can only *a priori* be taken as the finding of *ἀρχαί*; i.e. after the collection of the facts

(6) He was no professional astronomer. *De Caelo* I-II only deal with celestial physics.

(7) W. Kullmann, "Die Funktion der mathematischen Beispiele in Aristoteles' *Analytica posteriora*", in: *Aristotle on Science: The "Posterior Analytics"*. *Proceedings of the Eighth Symposium Aristotelicum held in Padua from September 2 to 15, 1978*, ed. by E. Berti, Padova 1981, 263ff.

an *examination* of the facts is necessary. One has to find out which facts can serve as proofs for other facts. The evident facts which cannot be proved must help to prove other facts while they themselves must be recognized as principles in a methodologically different way.

Good parallels to this presentation of the relationship between principle and fact are *E.N.* I 2.1095b 6 (*ἀρχὴ γὰρ τὸ ὅτι*) and I 7.1098b 2 (*τὸ δ' ὅτι πρῶτον καὶ ἀρχή*). The facts are *a priori* called principles.

There is another passage which is relevant in this connection. In *Anal. post.* I 23.84b 22ff. Aristotle says: *εἰ δὲ μὴ ἔστιν* (sc. *τι μέσον*), *οὐκέτι ἔστιν ἀπόδειξις, ἀλλ' ἢ ἐπὶ τὰς ἀρχὰς ὁδὸς αὕτη ἔστιν*. "If there is no further middle term, no further demonstration is possible, but the proper method is the way to the principles."⁸ As far as the search for middle terms is concerned, Aristotle does not in this context think of the *apodeixis* which runs from the principles to derived propositions, but he rather has in mind the proceeding questions of the researcher who is seeking for more and more explanations (i.e. logically for more and more middle terms) and so finally arrives at the principle. Only the end of this procedure and, in addition to it, the recognition of the principles on the "way to the principles", do make the *apodeixis* (in the strict sense) possible, the *apodeixis*, which runs in the direction opposite to the procedure here described by Aristotle. Apparently this procedure is an empirical one. In terms of syllogistics it is a chain of syllogisms of fact. In the following paragraph the metaphor of intervals on a line is used (84b 31ff.). Aristotle speaks of dividing an interval BA (A being the principle) by further middle terms until we reach an indivisible, unitary proposition which no longer admits of further packing.⁹ In connection with *Anal. post.* I 30 this passage becomes easily intelligible. The mere facts, which have been collected by way of *ιστορία* and which are represented by propositions in which certain properties are predicated of a substance, these facts are only the raw material for the search for the *αίτια*. They must be separated into definitional and non-definitional propositions and brought into a logical connection. Before deduction can start (A is C because of B; A is D because of C), we have to ask: Why is DA? Why is CA? This can be made explicit in the form of a syllogism of fact, but can also be graphically represented by an interval on a line marked by middle "terms". The principle itself cannot be elucidated by middle terms, but must be made evident by means of *ἐπαγωγή* and *νοῦς*. This means that two methods belong to the ascent: The "way to the principles" in

(8) Cf. the interpretation in M. Mignucci, *L'argomentazione dimostrativa in Aristotele. Commento agli Analitici secondi* I, Padova 1975, 506f.

(9) Cf. J. H. Leshner, "The Meaning of *ΝΟΨ* in the Posterior Analytics", *Phronesis* 18, 1973, 56f.

the strict sense (ἐπαγωγή, νοῦς) and the scientist's continuous search, via middle terms, which aims at the definition from which deduction starts.

We go on to the biological writings themselves.¹⁰ The distinction between φαινόμενα and αἰτίαι occurs in *PA* I 1.639 b 7ff., 640 a 14f. In *IA* 704 b 9f. the division διτι/διότι is found. Apparently the *HA* provides the διτι, *IA*, *PA* and *GA* the διότι. This is confirmed by *HA* I 6. On the one hand there are mentioned αἱ ὑπάρχουσαι διαφοραί καὶ τὰ συμβεβηκότα πᾶσι as well as ἱστορία, on the other hand αἰτίαι and ἀπόδειξις. The distinction also recurs in the expressions ἐξ ὧν and περὶ ὧν. The first one signifies the premisses, the last one the conclusions.¹¹

In which sense does *HA* provide the principles of proof in biology? In which sense are *IA*, *PA* and *GA* assigned to the presentation of the "why" and the causes?

We begin with the first question. The introduction of *HA* is very much in keeping with the model of *apodeixis* as developed in the *Analytics*. According to *Anal. pr.* I 30 it is necessary for the scientist to begin with collecting all propositions which could serve as premisses and conclusions in an apodeictic syllogism. To this Aristotle's statement in *HA* I 6.491 a 9f. corresponds: ... ἵνα πρῶτον τὰς ὑπαρχούσας διαφορὰς καὶ τὰ συμβεβηκότα πᾶσι λάβωμεν. *HA* is the collection of specific differences and necessary, non-definitional attributes of species and genera of animals. Both groups of attributes are not separated from each other. The necessary, non-definitional attributes are here called συμβεβηκότα. Of course, συμβεβηκότα καθ' αὐτά are meant. Long ago, Bonitz has pointed out that the unterminological use of συμβεβηκός is characteristic of the biological writings.¹² As matters stand, there is a much larger number of observations which refer to characters which are derived from definitions than observations which refer to definitional characters themselves. Therefore Aristotle sometimes describes the whole content of *HA* with the expression συμβεβηκότα καθ' αὐτά (*PA* I 5.645 b 1f.).

However, concerning the contents of *HA* some restrictions are necessary. According to the doctrine of *Anal. post.* II 13.96 a 24ff. and *PA* I 3.643 b 9ff., 23ff. the specific difference of a definition consists of several coordinate characters each of which is wider than the *definiendum*, but which taken together represent the *definiendum* exactly.

(10) Cf. W. Kullmann (see above n. 1) 255ff.

(11) Cf. W. Kullmann (see above n. 1) 81 and n. 8.

(12) H. Bonitz, *Aristotelische Studien* V, Sitzungsberichte der Österreichischen Akademie der Wissenschaften, Wien, philos.-hist. Cl., 55, 1867, 13ff., esp. 39 (reprinted in: H.B., *Aristotelische Studien. Fünf Teile in einem Band*, Hildesheim 1969, 317ff.); Id., *Index Aristotelicus* 713 b 43ff.

According to this theory the term διαφοραί in *HA* I 6.491 a 10 must be taken to mean only parts of specific differences. As regards the anonymous "greatest genus" of the reptiles and amphibia, such partial definitional features are probably τετράποδα, ἄποδα, ζεωτόκα, ὀρετόκα (and perhaps also φολιδωτά). Accordingly, the συμβεβηκότα (scil. καθ' αὐτά) are to be taken as partial non-definitional, necessary attributes which are derived from partial definitional attributes. The definition by means of specific differences which consist of a plurality of features has as its consequence the ἐπάλλαξις of classes, i.e. the overlapping of features which singly extend beyond the *definiendum*, but collectively do not (cf. *GA* II 1.732 b 15ff.).

The ascent in the strict sense is not documented in the biological writings. Only the raw material is laid down in *HA*. The research itself is not mentioned. It is certainly presupposed that the propositions of *HA* are supplied by αἴσθησις, as is confirmed by *Anal. post.* I 13.79 a 2f. There Aristotle says, dealing with the relationship between nautical and mathematical astronomy:

"Here it is the task of the observers to know the fact and of the mathematicians to know the reason."

ἐνταῦθα γὰρ τὸ μὲν ὅτι τῶν αἰσθητικῶν εἰδέναι, τὸ δὲ διότι τῶν μαθηματικῶν.

But the written presentation of ἐπαγωγή and of συλλογισμοὶ τοῦ ὅτι is lacking. In other fields of natural science the situation is different. In celestial physics (*De caelo* I and II) for instance we find a lot of syllogisms of fact.¹³ In this field it is partly necessary to infer the facts by analogical reasoning because they are not accessible to direct observation. Take for example the proximity of the planets and the spherical form of the moon in *Anal. post.* I 13. The following two passages are very instructive in this context:

De cael. II 3.286 a 4ff.:

"although we are trying to pursue our inquiries at a distance, not so much at a distance in space, but rather because very few of their attributes (i.e. attributes of the celestial bodies) are perceptible."

καίπερ πόρρωθεν πειρωμένοις ποιῆσθαι τὴν ζήτησιν, πόρρω δ' οὐχ οὕτω τῷ τόπῳ, πολὺ δὲ μᾶλλον τῷ τῶν συμβεβηκότων αὐτοῖς περὶ πάντων ὀλίγων ἔχειν αἴσθησιν.

(13) See P. Moraux, "La méthode d'Aristote dans l'étude du ciel", in: *Aristote et les problèmes de méthode*, ed. S. Mansion, Louvain 1961, 173ff., esp. 180f. (= Aristote, *Du ciel*, Collection Budé, Paris 1965, cviff., esp. cxiii); W. Kullmann, "Zur wissenschaftlichen Methode des Aristoteles", in: *Synusia, Festschrift Schadewaldt*, hrsg. v. H. Flashar und K. Gaiser, Pfullingen 1965, 247ff., esp. 255ff. (reprinted in: *Die Naturphilosophie des Aristoteles* [= *Wege der Forschung*, Bd. 225], ed. by G.A. Seeck, Darmstadt 1975, 301ff., esp. 316ff.).

II 12.292 a 15ff.

"although we have very little starting-points and are situated at so great a distance from the phenomena concerning them (i.e. the celestial bodies)."

καίπερ μικράς ἔχοντας ἀρορμάς καὶ τοσαύτην ἀπόστασιν ἀπέχοντας τῶν περὶ αὐτὰ συμβαινόντων.

In the biological writings we do not hear anything of Aristotle's research or of his scientific considerations. We can only reconstruct the gap between *HA* and *PA* from the presentation of his results in *PA* and from his theory in the *Analytics*. He had to start from the propositions stated in *HA*. In II 17.507 a 34ff., for example, he deals with the horned animals:

"In the first place, those quadrupeds and viviparous animals which are horned and have an incomplete set of teeth, have four such stomachs."

πρῶτον μὲν γὰρ τῶν τετραπόδων καὶ ζωτόκων ὅσα μὴ ἐστὶν ἀμφώδοντα τῶν κερατοφόρων, τέτταρας ἔχει τοὺς τοιούτους πόρους.

Before beginning with *apodeixis* Aristotle had to ask *why* these ruminants which possess a plurality of stomachs do not have teeth in both jaws and *why* they are horned animals. In order to answer these questions he had to refer to the law of compensation, according to which an excessive flux of material to the horns prevents the set of teeth to become complete. In terms of the *Analytics* this methodological procedure can be described as the combination of two syllogisms of fact, i.e. syllogisms which are established by immediate premisses, but not by the cause but by the more knowable of two convertible terms (I 13.78 a 26ff.).

We are passing on to our second question: In which sense does *PA* contain the presentation of the causes? After having completed his "research" Aristotle is able to give causal explanations. As for the ruminants he argues in the following order (which is opposite to the supposed order of the research):

III 2.663 b 31ff.:

"At any rate, in the larger animals there is present a surplus of this corporeal and earthy matter, produced as a residue, and this Nature makes use of and turns to advantage to provide them with means of defence. That portion of it which by necessity courses upwards she allots to form teeth and tusks in some animals, and to form horns in others. And we can see from this why no horned animal has incisor teeth in both jaws, but only in the bottom jaw. Nature has taken away from the teeth to add to the horns; so that the nourishment which would

normally be supplied to the upper teeth is here used to grow the horns."¹⁴ (tr. Peck)

τὴν γοῦν τοιοῦτου σώματος περισσώματικὴν ὑπερβολὴν ἐν τοῖς μείζουσι τῶν ζώων ὑπάρχουσιν ἐπὶ βοήθειαν καὶ τὸ συμφέρον καταχρῆται ἡ φύσις, καὶ τὴν ῥέουσιν ἐξ ἀνάγκης εἰς τὸν ἄνω τόπον τοῖς μὲν εἰς ὀδόντας καὶ χαυλιόδοντας ἀπένειμε, τοῖς δ' εἰς κέρατα. διὸ τῶν κερατοφόρων οὐδὲν ἐστὶν ἀμφώδον· ἄνω γὰρ οὐκ ἔχει τοὺς προσθίους ὀδόντας· ἀφελούσα γὰρ ἐντεῦθεν ἡ φύσις τοῖς κέρασι προσέθηκε, καὶ ἡ διδομένη τροφή εἰς τοὺς ὀδόντας τούτους εἰς τὴν τῶν κερμάτων αὔξησιν ἀναλίσκεται.

III 14.674 b 7ff.:

"Every one of the horned animals (such as the sheep, the ox, the goat, the deer, and the like) has several stomachs; and the purpose of them is this: Since the mouth is deficient in teeth, the service which it performs upon the food is deficient; and so one stomach after another receives the food." (tr. Peck)

τούτων δ' ἕκαστον πλείους ἔχει κοιλίας, ὅλον πρόβατον βοῦς αἰξ ἔλαφος καὶ τᾶλλα τὰ τοιαῦτα τῶν ζώων, ὅπως ἐπειδὴ τῆς ἐργασίας ἐλλείπει περὶ τὴν τροφήν ἡ λειτουργία ἢ τοῦ στόματος διὰ τὴν ἔνδειαν τῶν ὀδόντων, ἢ τῶν κοιλίων ἑτέρα πρὸς ἑτέρας δεχομένη τὴν τροφήν.

The underlying scheme may be supposed to be as follows:

Horned (animals) have an incomplete set of teeth.
Ruminants are horned.

Ruminants have an incomplete set of teeth.

(Animals) which have an incomplete set of teeth, have several stomachs.

Ruminants have an incomplete set of teeth.

Ruminants have several stomachs.

This schematization is no mere play, though we have to concede that Aristotle deliberately avoids any pedantry. It helps us to understand the intentions he has in mind in the biological writings.

Beyond that, the question arises what exactly Aristotle means, when he announces to deal with "causes". According to his usual

(14) This law of compensation is in a remote way analogous to the axioms mentioned in the *Posterior Analytics*. It is valid without being part of the course of demonstration. An attempt to discover other "general principles" in the biological writings can be found in A. Gotthelf, "First principles in Aristotle's *Parts of Animals*", in: *Philosophical issues in Aristotle's biology*, ed. by A. Gotthelf and J. G. Lennox, Cambridge 1987, 185ff.

doctrine only the formal cause can be established in an apodeictic syllogism (universality requirement). Yet, to return to the example quoted above, the incomplete formation of the teeth in ruminants seems to be the efficient cause for the plurality of stomachs, and the formation of the horns seems to be the efficient cause for the incompleteness of the teeth. In order to solve this contradiction, one would have to introduce the notion of a generalized efficient cause and to interpret it as a characteristic of the *eidos*, i.e. the species. For the species does not develop, whereas the efficient cause in the strict, not generalized sense belongs to the field of the contingent and becomes operative only in single natural processes so that it is scientifically inaccessible for Aristotle. But he does not say so.

Besides, one of the main themes of *PA* II-IV is the final causes of the parts (i.e. the functions of the tissues and the organs), as is announced in *PA* I. Since in the strict sense of the word the "final cause" also belongs to the field of contingency (*Anal. post.* II 11.95a6ff.), one would have to think of a generalized final cause in order to be able to equate it with the formal cause. But this is not stated clearly by Aristotle in *PA* either, and this has caused many misunderstandings of this treatise.

As I take it, Aristotle's indefiniteness has something to do with the fact that his concept of *eidos* (i.e. form or species) is of a static character. The *eidos* is defined by the appearance of an animal, when it is in an adult state. This can be illustrated by a passage from the *Metaphysics*:

Mel. © 8.1050a 2ff.:

"But here, too, it is clear, that also according to generation and time actuality is prior to potentiality. It is also prior in substance, because what is posterior in genesis is prior in form and substance (as for instance an adult in comparison with a child and a man in comparison with semen. For the one already has the *eidos*, the other not), and because everything which is coming-to-be moves towards a principle, i.e. an end (for the 'for the sake of which' is the principle, and the genesis is for the sake of the end)." (tr. Ross, with changes)

ἀλλ' οὖν καὶ ταύτη γε δῆλον ὅτι ἡ ἐνέργεια καὶ οὕτω προτέρα τῆς δυνάμεως κατὰ γένεσιν καὶ χρόνον. ἀλλὰ μὴν καὶ οὐσία γε, πρῶτον μὲν ὅτι τὰ τῇ γενέσει ὕστερα τῷ εἶδει καὶ τῇ οὐσίᾳ πρότερα (οἷον ἀνὴρ παιδὸς καὶ ἄνθρωπος σπέρματος· τὸ μὲν γὰρ ἤδη ἔχει τὸ εἶδος τὸ δ' οὐ), καὶ ὅτι ἅπαν ἐπ' ἀρχὴν βαδίζει τὸ γιγνόμενον καὶ τέλος (ἀρχὴ γὰρ τὸ οὐ ἔνεκα, τοῦ τέλους δὲ ἔνεκα ἡ γένεσις).

In Aristotle's conception of *eidos* no allowance is made for the origin and the development of the individual animal and the function of its parts. They cannot be gathered from the outward appearance of the fully grown animal. Aristotle's notion of *eidos* is not as abstract as the

notion of species in modern biology. Aristotle does not formulate: "In this species we find this feature in the embryonal stage and that feature in the adult stage". It is only in the adult stage that the *eidos* is fully reached.¹⁵ Whoever is interested in the question whether Aristotle was an essentialist or not, has to take this problem into account.¹⁶

These difficulties induce Aristotle to present the apodeixis in a special way, which is described in *PA* I 1.642a 31ff.:

δεικτέον δ' οὕτως, οἷον ὅτι ἔστι μὲν ἡ ἀναπνοὴ τοῦδι χάριν, τοῦτο δὲ γίγνεται διὰ τὰδε ἔξ ἀνάγκης. ἡ δ' ἀνάγκη ὅτε μὲν σημαίνει ὅτι εἰ ἐκεῖνο ἔσται τὸ οὐ ἔνεκα, ταῦτα ἀνάγκη ἔστιν ἔχειν, ὅτε δ' ὅτι ἔστιν οὕτως ἔχοντα καὶ πεφυκότα.

I paraphrase the passage as follows: "The *apodeixis* must be made in the following way: 'Respiration', for example, takes place for the sake of refrigeration (or for the sake of rendering life possible). But it necessarily comes to be by the activity of the lungs. Here necessity sometimes means that, if refrigeration will be the goal, it is necessary to possess respiration, sometimes that to a certain species refrigeration or respiration respectively essentially and necessarily belong."

According to this passage, as I take it,¹⁷ the final cause as well as the causation "of necessity" are to be shown, one after the other; in the latter case the expression "necessity" is again to be understood in two ways. Aristotle obviously intends (1) to show, with reference to a class of animals, what the aim of respiration is in the concrete case (i.e. the final cause, e.g. refrigeration), and (2a) to state that respiration and its efficient cause (! διὰ τὰδε) are hypothetically necessary to bring about refrigeration and render life possible in the concrete individual case; at the same time, it seems that he wants to maintain (2b) that refrigeration, the possession of lungs, etc., are essential properties of a certain class or genus of animals and therefore are absolute necessary. This interpretation goes back to William Ogle.¹⁸ It alone seems to allow a satisfactory explanation of the subdivision made shortly before in 642a 3ff. of the concept of necessity. It is not possible to assume that "accidental necessity" is meant, as had been suggested some time by David

(15) For the term *eidos* as denoting the visible aspect of a thing see now P. Pellegrin, "Logical difference and biological difference: the unity of Aristotle's thought", in: *Philosophical issues in Aristotle's biology* (see above n. 14), 322.

(16) Cf. D.M. Balme, "Aristotle's Biology was not Essentialist", *Archiv für Geschichte der Philosophie* 62, 1980, 1ff.; revised version in: *Philosophical issues in Aristotle's biology* (see above n. 14), 291ff.

(17) Cf. W. Kullmann, "Notwendigkeit in der Natur bei Aristoteles", in: *Aristoteles. Werk und Wirkung, Paul Moraux gewidmet, I. Aristoteles und seine Schule*, hrsg. v. J. Wiesner, Berlin-New York 1985, 207ff., esp. 218f.

(18) The Works of Aristotle, translated into English under the editorship of J.A. Smith and W.D. Ross, vol. V *De partibus animalium*, by W. Ogle, Oxford 1912: "such necessity as that which connects substances and their inherent properties and characters".

Balme.¹⁹ This necessity derives from material and does not contribute to the aim, although it only exists under the condition that an aim be accomplished (e.g. the blue colour of the eyes according to *GA* V 1.778a32ff.).²⁰ Balme rightly calls properties which are accidentally necessary (commonly Aristotle says: συμβαίνει ἐξ ἀνάγκης) "hypothetically necessitated, but ultimately not proximately".²¹ This necessity cannot be present here, for in the description of the second kind of necessity the qualifying addition "if this end will be" is missing and the second necessity is *opposed* to hypothetical necessity. There can neither be meant a mechanical, "Democritean", non-hypothetical necessity,²² the less so if understood as an absolute necessity in the Aristotelian sense.²³ For Aristotle unmistakably says in *GC* II 11 that, as far as movement and genesis is concerned, there is absolute necessity only inasmuch as these processes are *cyclical* (338a14f.: ἐν τῇ κύκλῳ ἄρα κινήσει καὶ γενέσει ἐστὶ τὸ ἐξ ἀνάγκης ἀπλῶς); and to this chapter Aristotle refers in *PA* I 1.640a8 (or already in 640a6f.).²⁴

In the following example and the following explanation of Aristotle (642a35ff.) likewise both meanings of necessity apply. As Aristotle calls two different but equivalent steps of the process ἀναγκαῖον, both the hypothetical and the absolute necessity can be thought of in both passages.

If this interpretation is correct, it means that wherever in the biological writings the term "necessity" occurs without further explanation, we can take it to mean either hypothetical necessity or absolute necessity. Even if Aristotle, as a scientist in the sense of *Anal. post.* and *Mel.*, only deals with something universal, such as species or genus of animals, he cannot leave out of account that the species and genera only take a concrete shape in the single developing animals. That may be the reason why he is sometimes forced to express himself as if his theme were not species and genera but developing individuals.

(19) D. M. Balme, *Aristotle's De Partibus animalium I and De generatione animalium I*, translated with notes, Oxford 1972, 101 and 80.

(20) Cf. D. Balme, "Greek Science and Mechanism I. Aristotle on Nature and Chance", *CIO* 33, 1939, 135; W. Kullmann, "Notwendigkeit" (see above n. 17) 226ff.

(21) Commentary (see above n. 19), 81.

(22) This view is held by J. M. Cooper, Hypothetical Necessity, in: *Aristotle on Nature and Living Things, Philosophical and Historical Studies, presented to D. M. Balme*, ed. by A. Gotthelf, Pittsburgh-Bristol 1985, 155; Id., "Hypothetical necessity and natural teleology", in: *Philosophical issues in Aristotle's biology* (see above n. 14), 258ff.; D. M. Balme, "Teleology and Necessity", *ibid.* 285 and n. 33 (converting from his former view, see above n. 19).

(23) D. Frede, "Aristotle on the Limits of Determinism: Accidental Causes in *Metaphysics* E 3", in: *Aristotle on Nature and Living Things* (see above n. 22) 215ff. Additions to the notion of necessity like "taken by itself", *ibid.* 216f., are qualifications which are incompatible with the status of absolute necessity.

(24) This chapter is not taken into consideration by the authors quoted in n. 22 and 23. — See also W. Kullmann, *Wissenschaft und Methode* (see above n. 1), 21ff.

But the passage is much disputed, and will remain difficult.²⁵ Therefore I leave it open whether (apart from *Anal. post.* II 11 and the beginning of *PA* I²⁶) there is an attempt of Aristotle to approximate final cause to formal cause. But I have no doubt that in *PA* he virtually thinks of a generalized final as well as efficient cause. Nevertheless he is unable to conceive the species in such an abstract way as we do. In comparison with other stages in the development of an animal a certain stage is distinguished by its perfection. Therefore Aristotle necessarily shrinks back from identifying conceptually the efficient and the final cause with the formal cause.

These problems point back to the Platonic background of Aristotelian science and have only had a small influence on the later reception of Aristotle's work. Theophrastus adopts the bipartition of science in *ιστορία/αἰτίαι* for botany, but with one important difference. The treatise *De causis plantarum* is confined to the treatment of the efficient cause. The final cause, which is of prime importance in *PA*, is touched upon by Theophrastus only in his *Historia plantarum*, and even there but occasionally.²⁷ The reason for that is not that Theophrastus attributed less importance to the final cause than Aristotle did. The explanation is rather to be found in the different subject of the botanical science. Theophrastus in fact follows Aristotle in his estimation of botany: as far as plants are concerned the final cause has a smaller rôle than in zoology. In Alexandrian medicine (in the 3rd century B.C.), which was to a large extent influenced by Aristotle, much emphasis was given to the cognition of the αἰτίαι, in opposition to the younger empiricists. Erasistratus, a pupil of Strato, wrote a treatise *περὶ αἰτιῶν*. He was probably dealing exclusively with the efficient cause. Thereby he answered those who claimed that diseases are ἀναιτιολόγητα (fr. 25 Deichgräber).²⁸ By the mediation of Galen as well as later on by direct translations of Aristotle the model of bipartite science was transmitted to the methodological doctrines of mediaeval and modern philosophy, to Grosseteste, to Roger Bacon, to Galileo and to many others.^{29*}

(25) But cf. W. Kullmann, "Der wissenschaftliche Charakter der Biologie des Aristoteles. Eine Überprüfung", in: *Gedankenzeichen. Festschrift Klaus Oehler*, ed. by R. Claussen and R. Daube-Schackat, Tübingen 1988, 16ff.

(26) Cf. W. Kullmann, *Wissenschaft und Methode* (see above n. 1) 277ff.; 13ff.; Id., "Der wissenschaftliche Charakter" (see above n. 25) 14ff.

(27) Cf. G. Wöhrle, *Theophrastus Methode in seinen botanischen Schriften* (= *Studien zur antiken Philosophie*, hrsg. v. H. Flashar, H. Görgemanns, W. Kullmann, Bd. 13), Amsterdam 1985, 84ff.

(28) Cf. K. Deichgräber, *Die griechische Empirikerschule. Sammlung der Fragmente und Darstellung der Lehre*, Berlin 1930, 278f.

(29) Cf. A. C. Crombie, *Robert Grosseteste and the Origins of Experimental Science 1100-1700*, Oxford 1953.

* I thank my son, Dr. Thomas Kullmann, for his help in establishing the English version of this paper.

NECESSITY AND EXPLANATION IN ARISTOTLE'S *ANALYTICS*

ARYEH KOSMAN

In this paper I propose to consider two questions about necessity. The first concerns a problem in the interpretation of Aristotle's modal logic. In Book I of the *Prior Analytics*, in the course of discussing modal syllogisms, Aristotle makes claims that seem inconsistent with one another, or that seem based on inconsistent views about the nature of modal propositions; is there any way to make Aristotle's modal logic coherent? The second is a question about the nature and role of modality in the task of scientific explanation. In Book I of the *Posterior Analytics*, Aristotle argues that *epistêmê*, the understanding that comes about by explanation and enables explanation, is of the necessary and proceeds *from* the necessary; what does he mean by this?

It is not obvious that these two questions are related to one another, but I hope to show that they are. I will suggest that it is fruitful to think of the second question as involving the interpretation of that concept of necessity whose purely formal consideration in the *Prior Analytics* generates the first question. The scope of this essay is thus a modest one; it is to suggest that well known difficulties in Aristotle's modal logic may become clearer when we recognize the unity of the enterprises which shape the discussions of the two halves of Aristotle's *Analytics*.

1. Aristotle's account of mixed modal syllogisms.

First, then, about modal syllogistic; the story I am about to tell is by now a familiar one.¹ Partway through Book I of the *Prior*

(1) It is discussed by A. Becker, *Die aristotelische Theorie der Möglichkeitsschlüsse* (Berlin, 1933), by Stoors MacCall, *Aristotle's modal syllogisms* (Amsterdam, 1963) by

Analytically, Aristotle considers what we might call *hybrid modal syllogisms*, and in particular, in Chapter 9, he considers syllogisms one of whose premises is necessary and the other of which is assertoric. The outcome of such syllogisms, he argues, differs depending upon which of the premises exhibits which of the modalities. For if, he claims, the *major* premise of a demonstrative syllogism is necessary, there follows a conclusion that is also necessary; but if it is the *minor* premise that is necessary, the conclusion that is generated is merely assertoric. "For example," Aristotle writes,

assume that A belongs or does not belong to B of necessity, and that B belongs simply to C. If we make this assumption, then A will also belong or not belong to C of necessity. For since A belongs or does not belong of necessity to every B, and C is one of the Bs, it is clear that A will also of necessity either belong or not belong to C. But if the AB premise is not necessary whereas the BC premise is necessary, the conclusion will not be necessary. For if it were, it would follow that A belongs to some B of necessity, by the first and third figure. But this is not true.²

Consider, for the sake of simplicity, only cases of belonging, that is, consider syllogisms consisting of universal affirmative premises. Aristotle's claim is that in the case of these two hybrid Barbaras, the inheritance of the trait of necessity follows the modality of the dominant major premise rather than that of the recessive minor premise. *Necessarily AaB* and *BaC* yields *necessarily AaC*, whereas *AaB* and *necessarily BaC* yields merely *AaC*.³

This claim of Aristotle's has constituted for many commentators a difficult crux in Aristotle's modal logic. According to Alexander, the claim met with immediate disagreement on the part of Aristotle's successors; in his commentary on the *Prior Analytics*, Alexander explains Aristotle's remarks, and then adds:

But his followers who were in the circle of Theophrastus and Eudemus deny this; they say instead that in all cases in which a combination of a necessary and an assertoric premise constitute a syllogism, the conclusion that results is assertoric. They infer this from the principle that in all such combinations the conclusion is similar to the least and weaker premise.⁴

Nicholas Rescher, "Aristotle's theory of modal syllogisms and its interpretation", in *The critical approach to science and philosophy*, ed. Mario Bunge (Glencoe, 1964), 152-177, by Wolfgang Wieland, "Die aristotelische Theorie der Syllogismen mit modal gemischten Prämissen", *Phronesis* 20 (1975) 77-92 and most recently by Richard Patterson, "The case of the two barbaras: Basic approaches to Aristotle's modal logic", forthcoming in *Oxford Studies in Ancient Philosophy*.

(2) *Prior Analytics* I, 9, 30a15ff.

(3) Where "PaS" symbolizes "P belongs to all S", "PoS" "P belongs to no S", etc.

(4) Alexander Aphrodesiensis, *In Aristotelis Analyticorum Priorum Librum I Commentarium*, ed. M. Wallies (*Commentaria in Aristotelem Graeca* 2.1, Berlin, 1883) 124,8ff. Cf also 173,32ff. and 119,7ff.; John Philoponus, *In Aristotelis Analytica Priora commentaria*, ed. M. Wallies (*Commentaria in Aristotelem Graeca* 13.2, Berlin, 1905)

The "least and weaker" principle to which Aristotle's critics appeal, and which was to become the Scholastic modal dictum *peiores semper sequitur conclusio parlem*, reveals a more Mendelian model of modal inheritance at work in the thinking of Theophrastus and Eudemus; on their understanding, it is the trait of necessity itself, rather than one or another of the parent premises, that is recessive, and the trait of non-necessity that is dominant.

2. What this account suggests about Aristotle's theory of modal propositions.

We might interpret the disagreement between Aristotle and Theophrastus by supposing that the two have different pictures of the deep structure of modal propositions. Suppose that Theophrastus (inspired perhaps by a reading of *On Interpretation*) thought of modality as a feature of the entire quantified proposition, and not as a feature either of the proposition prior to quantification or of one of its arguments. Thinking the modal operator thus located, as it were, outside the quantified premise and thinking of the syllogism on the model of a chain only as strong as its weakest link, he then disallowed the inference of modally "stronger" conclusions from "weaker" premises.

Aristotle's view, on the other hand, suggests an interpretation of the structure of necessary propositions that places the modal operator *within* the scope of the quantifier; universal necessary affirmative propositions, for example, have the form $(x)[Sx \rightarrow NecPx]$. Such a conception generates precisely the distinction Aristotle makes. For it reveals one of the hybrid Barbaras to lead to a necessary conclusion: $(x)[Mx \rightarrow NecPx]$ and $(x)[Sx \rightarrow Mx]$ yield $(x)[Sx \rightarrow NecPx]$. But it reveals the conclusion of the other Barbara to be restricted, just as our text requires: $(x)[Mx \rightarrow Px]$ and $(x)[Sx \rightarrow NecMx]$ clearly do not yield the necessary conclusion $(x)[Sx \rightarrow NecPx]$. We might be concerned that $(x)[Mx \rightarrow Px]$ and $(x)[Sx \rightarrow NecMx]$ do not immediately yield any conclusion; but on the assumption that $Necp \rightarrow p$ is a valid modal principle, we can easily generate a more fruitful minor: $(x)[Mx \rightarrow Px]$ and $(x)[NecMx \rightarrow Mx]$ yield $(x)[NecMx \rightarrow Px]$. And that minor, together with the original major, will yield just the assertoric conclusion which Aristotle claims follows from this syllogism.

In addition to such formal considerations, this reading may be attractive for other reasons. For it may suggest that Aristotle's doctrine of the two hybrid Barbaras demands an interpretation of

205,13ff.; 123,15ff.; 129,16ff.; Ammonius, *In Aristotelis Analyticorum Priorum librum I commentarium*, ed. M. Wallies (*Commentaria in Aristotelem Graeca* 4.6, Berlin, 1899) 45,42ff.

modality and of the modal proposition that is *de re* rather than *de dicto*, suggesting as it does that necessity holds of individuals independently of the description under which they are introduced. And this may agree with what we expect from Aristotle; necessity is a feature of the belonging of a predicate to a subject, and is not to be understood in terms of analyticity.⁵

3. A difficulty in Aristotle's theory.

The story might end here, with what seems a plausible account of his understanding of the structure of modal propositions, were it not for Aristotle's repeated claims that modal propositions convert in the same way as do simple assertoric propositions. This is how Aristotle opens chapter 3 of *Prior Analytics* I:

it works the same way with necessary premises. For a universal negative converts universally, while each of the affirmatives converts *kalameros*. For if A necessarily belongs to no B, then B necessarily belongs to no A. For if it might belong to some, then A might belong to some B.⁶

This is not simply an isolated claim on Aristotle's part; the conversion of modal propositions is a critical — we might even say necessary — part of his general discussion of the modal syllogism. For it is the conversion of modal propositions that allows for the reduction of modal syllogisms in the second and third figure to the perfect syllogisms of the first, just as in the case of the standard assertoric syllogistic. The conversion is therefore no minor part of the modal syllogistic.

But the account we have been considering, which locates the modal operator within the quantified proposition, will not allow such conversion to take place. No obvious rule of logic could allow us to infer $(Ex)[NecSx \& Px]$ from $(x)[Sx \rightarrow NecPx]$ or from $(Ex)[Sx \& NecPx]$, nor to infer $(x)[Px \rightarrow Nec \sim Sx]$ from $(x)[Sx \rightarrow Nec \sim Px]$.

The conversions Aristotle allows could be understood if we were to imagine the modal operator as outside the entire quantified proposition, so that necessary A propositions, for example, have the form $Nec(x)[Sx \rightarrow Px]$. But such an understanding makes inexplicable the syllogisms of mixed modality, and suggest a relationship between

(5) This is a more complex and in many respects separate issue from the one with which we are here concerned; I have considered the question of whether there is a doctrine of *de re* necessity in Aristotle in a forthcoming piece "Aristotle's essences and Aristotelian essentialism". The reading of the structure of modal propositions suggested here seems also to be assumed by Aristotle later in his discussion of modal reasoning when, in chapter 17 of Book I, he rejects the conversion of negative universal contingent propositions. I argued for this point in an earlier essay more optimistic about the possibility of an easy coherence in Aristotle's modal logic, "Aristotle on inconvertible modal propositions" *Mind* 79 (1970), 254ff.

(6) *Prior Analytics* I 3, 25a28ff.

modality and the quantified proposition that we should not expect from Aristotle.

4. A possible solution to the difficulty in Aristotle's theory.

What should we do? We might follow the strategy of Aristotle's earliest followers and interpret the mixed Barbaras as a simple mistake on Aristotle's part. Albrecht Becker, in a monograph published in 1933, offers another suggestion.⁷ In Becker's view, there are two different Aristotelian interpretations of the deep structure of the modal proposition, one at work when Aristotle considers the two Barbaras, and the other at work when he considers the conversion of modal propositions.

Becker rests much on Aristotle's claim in chapter 13 of *Prior Analytics* I, when, in a parallel discussion of contingent propositions, he observes:

The expression *it is possible for this to belong to that* may be understood in two ways: [it is possible for this to belong] either to the thing to which that belongs or to the thing to which that can belong.⁸

This observation seems to Becker to yield two different Aristotelian interpretations of what I have called the deep structure of modal propositions, in this case of propositions asserting possibility: a contingent A proposition may be thought of as a proposition (I) with the structure $(x)[Sx \rightarrow PosPx]$ or (II) with the structure $(x)[PosSx \rightarrow PosPx]$.

If we understand these two structures as governing Aristotle's discussion of modal propositions in general, then the anomalies which we have noted in the modal syllogistic are explicable. For as we have seen, construing necessary A propositions as having the form (I) $(x)[Sx \rightarrow NecPx]$ makes understandable the distinction between the two forms of syllogism with premisses of mixed modality. If, on the other hand, we think of such propositions as having the form (II) $(x)[NecSx \rightarrow NecPx]$ and of the corresponding I propositions as having the form $(Ex)[NecSx \& NecPx]$, Aristotle's remarks concerning conversion become understandable, and without the necessity of imagining the modal operator outside the entire quantified proposition.

Becker's interpretation, however, merely uncovers the source of the anomaly in Aristotle's thinking; on his interpretation, Aristotle's modal logic remains muddled, resting on two quite different understandings of the structure of modal propositions. But it is difficult to imagine, if Becker is right, that Aristotle was simply confused in his sense of this distinction or of its application to the modal proposition. This is due not merely to the strong hermeneutical principle *Aristoteles raro confusus*

(7) Becker, *Die aristotelische Theorie der Möglichkeitsschlüsse*, op. cit.

(8) *Prior Analytics* I, 13 32b15.

est; in this case that hermeneutical principle is bolstered by the very statement of Aristotle on which Becker rests his distinction, as well as by other evidence of Aristotle's understanding of the distinction.⁹ Becker in fact does not accuse Aristotle of confusion, but merely of ambivalence. But the question we need to ask if this ambivalence is not to be read as a sign of confusion is this: is there any way in which we can understand the ambivalence to be grounded in a coherent project of Aristotle's?

Nicholas Rescher has more recently offered an alternative understanding of the mixed modal syllogisms which is ingenious, but whose baroque complexity is difficult to discover in Aristotle's discussion.¹⁰ Rescher's interpretation, however, has the considerable virtue of interpreting the modal syllogistic in light of Aristotle's discussion in the *Posterior Analytics*. It thus reminds us that the discussions in the two parts of the *Analytics* are of a piece, and that the semantic interpretation of the *Prior Analytics*' formal notion of modality may most aptly be looked for in the necessity which the *Posterior Analytics* deems requisite for scientific understanding. It is for this reason that I turn to the first book of the *Posterior Analytics* and to the question of explanatory modality.

5. Understanding and necessity.

In the *Posterior Analytics* the recognition of necessity is said by Aristotle to be a mark of proper scientific understanding.

We think we understand something in an unqualified sense, and not in the sophistical or accidental sense, when we know both of the cause that is responsible for its being the case that it is the cause and that things could not be otherwise.¹¹

If we think of Aristotle's discussion of *epistēmē* on the model of modern discussions of *knowledge*, in a context governed by concepts of doubt, justification and certainty, it may seem to us that the demand that the proper object of *epistēmē* be necessary is meant as a condition for the possibility of certainty, as a guard against the eventuality of error. But once we have come to recognize that the governing contexts of the *Posterior Analytics* are those of *understanding* and *explanation*,¹² a

(9) In *Sophistical Refutations* 166a23, for example, where the scholastic distinction between modality *in sensu diviso* and *in sensu composito* seems to have its origin.

(10) Nicholas Rescher, "Aristotle's theory of modal syllogisms and its interpretation", *op. cit.*

(11) *Posterior Analytics* I 2, 71b9 ff.

(12) As I hope we by now have come to recognize: see my "Understanding, explanation and insight in Aristotle's *Posterior Analytics*", in *Exegesis and argument* (edd. E. N. Lee, A. P. D. Mourelatos, R. M. Rorty), *Phronesis* supp. vol. I (Assen, 1973) and M. F. Burnyeat, "Aristotle on understanding knowledge", in *Aristotle on science. The Posterior Analytics (Proceedings of the Eighth Symposium Aristotelicum*, ed. Enrico Berti, Padua, 1981).

somewhat different interpretation of Aristotle's remarks will seem appropriate.

We say we have understood something when we think we know (and therefore can reveal) *why* it *must* be the case that it is so. There is not yet understanding of such a thing being the case as long as we have only shown that it *might* be the case; for we could still ask; why, given that it doesn't *have* to be the case, *is* it the case? That question, which is precisely the demand for explanation, will be answered only when we recognize that given these and these causes, it *must* result that such and such is the case. The explanatory demand, in other words, is fully satisfied and brought to rest only by the invocation of necessity.

Aristotle's requirement of necessity in scientific understanding does not, therefore, reflect a theory according to which, for the sake of *certainly*, only the necessary can be the object of proper knowledge, but a theory according to which necessity is a feature of *explanation*, since successfully to explain something is to show why it must be so. The necessity in question, therefore, is a necessity which comes to be *revealed* in the development of explanatory understanding; it is not a necessity of which we need be aware prior to and independently of scientific demonstration. Nor is it, therefore, the necessity of a *pragma* simpliciter, but of a *conclusion* insofar as it has been explained, that is, revealed to be necessitated by the cause invoked in the *apodeixis* which explains it.

The nature of explanatory modality is made clear when Aristotle subsequently observes that the necessity of what is explained must be revealed by way of explanation from premises which are in turn necessary in just the same sense. In one sense, this further requirement is a consequence of the fact that, as the recursive nature of Aristotle's theory makes clear, there is not yet scientific understanding of something if that by virtue of which it is explained is not itself understood. But in addition, it makes clear that no necessity of the conclusion simpliciter is sufficient to satisfy Aristotle's theoretical demands. In the sixth chapter of *Posterior Analytics* I, Aristotle stresses that even when a conclusion is necessary, there will not be full explanatory understanding unless both of the premises as well exhibit the necessity in question; if either premise fails to reveal a necessary connection of the middle, there will not be an understanding of the reason why the conclusion must exhibit the connection it does, and there will therefore not be *epistēmē* properly understood.¹³

Consider more generally what's demanded in an explanation. A certain *pragma* consists of one sort of thing being another; the office of

(13) *Posterior Analytics* I 6, 74b26 ff., 75a1 ff.

explanation is one of revealing why this has to be so. An explanation, in other words, attempts to show why an entity that may be identified under one description may, just because it can be identified under that description, also be identified under another description. This possibility of redescription is revealed to be a feature of the necessity of connection among alternative descriptions; an explanation attempts to show, in other words, that it is not simply an accident that some entity which is F is also G, since the description by which the entity is specified as being F is connected by some sort of necessary connection to the description by which the entity is specified as being G. This explanatory office, as we know, is accomplished by the middle.

This means that the explanation we want is one in which both premises are necessary. For if we want to show the necessary connection of two descriptions by means of another description (the middle), then for each of the first two descriptions, the connection of that description to the middle must be *understood*, and must therefore exhibit the same kind of necessary connection that we are trying to achieve for the conclusion, that is, for the *explanandum* that is to be the immediate object of our understanding. Each extreme term, therefore, (that is each of the descriptions which determine the poles of predicative being of the *explanandum*) must be connected to the middle by necessity if the middle is to serve as an *explanans*.

In the paradigm of scientific understanding, therefore, explanation is from necessary premises; for we have a phenomenon under a certain description which brings together two terms, and explanation is achieved through the middle which, by specifying the phenomenon under a more general mediating description, reveals the explanatory connection between the two terms. Each of the premises by which this explanatory mediation is accomplished is standardly itself a conclusion of some prior apodictic syllogism. And since the conclusion of a syllogism is simply the perfected form of the premises of which the syllogism consists,¹⁴ the necessary premises of a scientific explanation reveal a connection effected by prior necessary connections to a prior middle which has been sublimed in the subsequent act of inference. Conversely, this middle is invisibly present in our prescientific experience and is only brought out in those acts of *epagôgê* and *apodeixis* by which the scientist reveals that middle which explains the connection. And this is for Aristotle precisely the essential project of science; science just is the act of revealing the ramified syllogistic of what in the first moment of scientific awareness appears to us as conclusion, without it yet being understood: conclusion of *what*.

(14) This is why "*symperasma*" sometimes means the terms of the syllogism, as at *Prior Analytics* II 1, 53a17, where Waitz and Bonitz introduce a derivative sense.

6. *Syllogistic necessity and the necessity of scientific understanding.*

We turned to the question of necessity in the *Posterior Analytics* following the suggestion that the so-called *Prior* and *Posterior Analytics* form a single work, whose subject matter is, as Aristotle announces in its opening lines, explanation and explanatory understanding: *apodeixis* and *epistêmê apodeiklikê*.¹⁵ If this suggestion is correct, then we should expect the issues of the first two books of this work to be preparatory to the discussion of *epistêmê apodeiklikê* in the latter two books; the structure of syllogism, for example, is investigated because *apodeixis* is accomplished by *sylogismos*, that is to say, because scientific explanation takes place by means of reasoned discourse.

This is not to say that the formal logic of the *Prior Analytics* is nothing but the handmaiden of the subsequent account of scientific explanation in the *Posterior Analytics*. Here, as standardly in Aristotle, the shape of discussion owes as much to Aristotle's natural curiosity, his passion for completeness, and his associative style of organization as to any clear agenda of premises in a large architectonically ordered argument. The formal structure of syllogistic clearly takes on a life of its own in the *Prior Analytics*, and Aristotle's interest in the elaboration of a formal logic of deduction reaches well beyond his immediate needs for the argument concerning *apodeixis* in the *Posterior Analytics*.

Nor is it to say that the *Analytics* is a manual for carrying out the activities of explanatory science. The *Analytics* is an abstract and formal theoretical essay; it presents a model of scientific understanding by idealizing and formalizing the structures of normal explanatory activity, i.e. of science. It is not, so to speak, a theory of a formally abstract and idealized scientific practice, but a formalized theory of actual scientific practice. Scientists do not construct syllogisms in one figure or another of the sort we encounter in the *Prior Analytics*; they construct complex bodies of explanatory discourse, such as we find, for example, in the *Parts of Animals*, and we are able to understand these bodies of discourse as instances of formal syllogistic only when the philosopher has performed his (characteristically posterior) analysis.¹⁶

But given these qualifications, we should expect to find that the choice and treatment of topics in the two works is in general governed by a single interest, the interest in the nature of explanatory science, and its most obvious activity, that of scientific explanation. And so we

(15) *Prior Analytics* I 1, 24a10.

(16) See the extended use of this principle by Allan Gotthelf in his essay "First principles in Aristotle's *Parts of Animals*", in *Philosophical issues in Aristotle's biology* (edd. A. Gotthelf and J. Lennox Cambridge, 1987), 190ff.

should expect to discover that the necessity of *Analytically* I, that is, of the first book of the *Prior Analytics*, is the formal analogue of the necessity of scientific explanation demanded in *Analytically* III, that is, in the first book of the *Posterior Analytics*.

Standardly, therefore, a modal logic which purports to exhibit the paradigmatic form of explanatory reasoning will be concerned with propositions which are of the form Necessarily PaS — P belongs necessarily to all S — and whose deep structure may be represented as $(x)[\text{NecS}x \rightarrow \text{NecP}x]$. For each of such propositions will represent a sublimed form of two necessary premises prior to it; each will represent a conclusion in which the prior necessary linking middle which mediates those premises has been suppressed. Propositions of this form, which clearly convert, constitute the standard type of proposition that Aristotle has in mind and exhibit the standard structure of modal necessity invoked throughout the *Analytically*. It is this structure which Becker properly recognizes in his *second* model of the modal propositions, a structure that explains Aristotle's standard modal syllogistic and his standard forms of modal conversion.

But is there anything in this account that might help us understand why Aristotle makes the distinction between the two forms of mixed modal syllogism with which we began, the distinction which struck us as recommending Becker's *first* model of modal structure, a model according to which one thing is said to belong necessarily to subjects to which another belongs simply? For this we need to think again about the question of explanatory necessity.

7. Necessity and explanation again.

Our aim in the discursive activity of science is to understand why some S or other is some P or other. This understanding, we saw, is achieved by *apodeixis*, by an explanation that shows why it is the case that an entity under a certain description must also be specifiable under another. Standardly, I have suggested, such explanation occurs in contexts in which the two descriptions are related necessarily through a third description which constitutes a middle, in turn related necessarily to each. S has to be P because S has to be M and M has to be P.

But if science has both its source and telos in the particularity of experience, we will wish to be able to countenance explanations of a different sort as well. For we will want to be able to account for instances of reasoning by which an entity under a certain description comes to be understood to exhibit another being, even though the first description may not play a critical role in effecting the understanding; that description may merely pick out the entity whose being is thus to be explained, but not be related necessarily to the middle that explains why it exhibits the being it does.

Consider for example these cases. We wish to understand why the moon is in eclipse. We are offered this explanation: the moon is (at the moment) a body with an opaque substance interposed between it and its light source, and beings of that sort (for these and these reasons) eclipse. Or imagine our wishing to understand why the interior angles of a certain figure are equal to two right angles. We're given this explanation: the figure in question is a triangle, and the interior angles of a triangle (for these and these reasons) are equal to two right angles. It seems that in each of these cases we have been given an *apodeixis* the formal representation of which is considered in the *Analytically*; for haven't we been given in each case an explanation which is productive of scientific understanding?

But in each of these cases, the entity in question is initially specified by a description which is not necessarily connected to the explanatory middle. In order to realize that fact, contrast the minimal explanations given with the deeper explanations parenthetically figured in each case by the phrase "for these and these reasons". The preliminary middles — *body with an opaque substance interposed between it and its light source* and *triangle* — are related by necessity to these further and deeper explanatory middles which relate them necessarily to the predicate in question; but it is only contingently true that the moon is a body of that sort or that the figure in question is a triangle. Each of the entities in question, therefore, exhibits the characteristic which is explained, but does not exhibit that characteristic necessarily insofar as it is specified by its initial description, but rather insofar as it can be specified by some *other* description to which the characteristic *is* related necessarily. It is therefore only in a qualified sense that one is able to explain why the figure before me has two right angles, or why that shining globe above the horizon eclipses. What can really be explained, by means of the further and more revealing middles, is why *a triangle*, which the figure before me happens to be, has two right triangles, or why *a body with an opaque substance interposed between it and its light source*, which the moon happens to be, eclipses.¹⁷

In the case of these initial explanations, then, the connection to the explanatory middle expressed in the minor premise is not a necessary one, although that of the major is. When Aristotle considers the modal

(17) I think that the relation between these initial explanations and the deeper explanations which, as we will see, they point to, bears an interesting resemblance to the relation between A-type and B-type explanations that James Lennox develops in his essay "Divide and explain: the *Posterior Analytics* in practice", in *Philosophical issues in Aristotle's biology*, op. cit. 90 ff. It may indeed be the case that the entire discussion which I've here devoted to explanations of the particular qua individual is more appropriate with respect to explanations of the particular qua what is *kala meros* in the sense Lennox explains.

status of the premises of scientific demonstration in the sixth chapter of *Posterior Analytics* I, he denies, as we have seen, that demonstrations whose premises are not necessary are capable of generating understanding in the full sense which the *Posterior Analytics* sets out to clarify. Among the arguments he sets out is the following; if, he says,

someone who doesn't have an account of the causal reason [*dia ti*], even when there's a demonstration doesn't have scientific understanding, then if A belongs necessarily to C, but the middle term B, through which [the conclusion] is demonstrated, does not belong necessarily, he doesn't know the reason why [*dioti*]. For it's not so by virtue of the middle, since it's possible for the middle not to be the case, whereas the conclusion is necessary.¹⁸

For, Aristotle continues in an interesting and revealing aside,

when the conclusion is necessary, nothing prevents the middle through which it is demonstrated from not being necessary.¹⁹

The preliminary modes of explanation we have been considering are, I suggest, instances of just these imperfect demonstrations to which Aristotle here denies the power to produce full scientific understanding. Note further that these demonstrations are formally represented by the very syllogisms of mixed modality with which we began. This possibility is entertained by Barnes in his commentary on the *Posterior Analytics*, but dismissed because he finds it, in his words, "piquant ... but perhaps too subtle".²⁰ But it seems to me difficult to avoid the conclusion that the syllogistic forms to which Aristotle refers in this early chapter of the *Posterior Analytics* are precisely those forms of mixed modal reasoning he discusses earlier; here is the necessary major, the merely assertoric minor, and that troublesome necessity of conclusion which we encounter in *Prior Analytics* I 9.

In these cases, scientific understanding in the full sense has indeed not yet been accomplished. For the deeper causal explanation which necessarily links, for example, the figure qua triangle to its having two right angles has not yet been revealed. But what has been revealed is the very nature to which we must look if we are to find such a deeper explanation; what has been revealed is the fact that the figure's having two right angles can only be understood insofar it is apprehended as this *triangle*, and not merely as this *figure*. The denial of unqualified understanding is thus a sign of Aristotle's commitment to the power and the necessity of proper and essential description in the enterprise of scientific explanation. The object of understanding is for Aristotle only qualifiedly the contingent and particular fact that is at first to be

(18) *Posterior Analytics* I 6, 74b26 ff.

(19) *Posterior Analytics* I 6, 75a1 ff.

(20) Jonathan Barnes, *Aristotle's Posterior Analytics* (Oxford, 1975), 125.

explained, for example, that a certain figure has two right angles; properly it is that anything which falls under a certain description has two right angles. It is thus as we have seen only contingently true that *this figure* has two right angles; necessity attaches only to our understanding that *a triangle*, which this figure happens to be, has two right angles.

But what follows from this is important; it is that the first essential task of scientific explanation will be the noetic task of correctly describing particulars, of finding the right universal to characterize those beings which have been picked out by the mere *thises* and *thats* of our initial discourse. It is important that this is a task of proper description, and that understanding in these cases is not absent, but hidden, obscured by the distracting overdetermination of the particular. Our ultimate objective in the enterprise of understanding — whether as scientists or as philosophers — is not to turn away from the particular but to make it manifest, to *demonstrate* it. The aim is not to leave it in darkness while we attend to and shed the light of *nous* upon the universal and abstract; it is to reveal the particular by casting it in that light which shows it for what it is and why it is what it is.

Our first task in that enterprise must therefore be one of discovering the particular in terms which do more than merely indicate it to us, but which disclose as well that nature which will be the subject of a more revealing *apodeixis*. The general form of such activity is *epagôgê*, which Aristotle describes as the activity that "reveals the universal by making clear the particular" (*deiknuntēs lo katholou dia lou dêlon einai lo kath'hekaston*).²¹ It is exactly this initial project of scientific understanding that is performed by the instances of preliminary explanation we have been considering, explanations which I have suggested are represented formally by the syllogisms of mixed modality of *Prior Analytics*. It is as if Aristotle envisions at the outset of all scientific understanding hybrid syllogisms of the form: triangle belongs contingently to this figure; having two right angles belongs necessarily to triangle; therefore having two right angles belongs necessarily to *this figure qua triangle*.

What this means is that in a limited but important sense we have in fact begun to explain why the angles of the figure before me are equal to two right angles, and why that light in the sky has gone out. We have done so just insofar as we have revealed the figure before me to be that sort of figure, or the light to be that sort of light and of that sort of body, for which we are then able to provide the true causal explanations by which necessity will be revealed: not until we have, but nevertheless

(21) *Posterior Analytics* I 1, 71a8.

insofar as we have. And this characteristically Greek "nevertheless" must be true if *experience made intelligible* is to be the ultimate source and telos of science.

This last fact should finally help us realize why Aristotle introduces syllogisms of mixed modality with necessary conclusions. Consider for a moment Aristotle's parallel strategy in the *Metaphysics*. Like the platonists, he wishes to restrict substantial being to per se being and to restrict per se being to the robust formality of an entity being what it is. But unlike the platonist, he wants to resist the disavowal of that being from the entity which exhibits it, and to deny an ontology whose central image is that of entities separate from and therefore in relation to their formal being; at the heart of his ontology is the vision of substantial entities which are themselves. So here, Aristotle wants to restrict the world of understanding to the world of per se and necessary being. But he wants to deny that the world of the necessary is anything other than the world of the contingent understood properly in terms of its necessary rational structure; he wants, in other words, to resist a platonist separation of contingency from necessity. At the heart of all our reasoning about that intelligible structure of necessity by which the world is understood is the recognition of the incorporated unity of that structure with the dumb singularity of the particular.²²

There is at the core of all explanation then, in the act the medievals called *compositio*, the synthesis of a particular with the necessary structure of its being, a recognition that some *this* is *such and such*. If we hope to account finally for this fact, we will have to introduce syllogisms of mixed modality. This is the insight that lies behind *Prior Analytics* I 9, which introduces exactly such syllogisms and claims that their conclusions will be necessary, even though, as we learn in the *Posterior Analytics*, they do not represent unqualified *understanding*. The subsequent tradition which joins Theophrastus in denying validity to mixed Barbaras with assertoric minor and necessary conclusion courts the danger of the separation that Aristotle means to avoid; it risks precisely that dissociation of particularity and being that he saw as the chief difficulty of platonism.

In one sense, this is all Aristotle's rabbit out of the hat trick, and mixed modal syllogisms with necessary conclusions, since they seem to pull apodictic rabbits out of assertoric hats, must seem to the Theophrastuses of the world like the most outrageous form of legerdemain. But it is in fact a rabbit that gets pulled out, and it was in fact in the hat. The magic in other words is genuine, that is to say,

(22) Small wonder that Aristotle was as attractive as he was to those religious traditions in which (one or another form of) hypostatic unity was mythically central.

depends upon very skillful sleight of hand. The sleight consists in knowing how to understand the world properly, that is, in knowing what are the appropriate descriptions in terms of which individual entities come to be understood. The magic, that is to say, is the magic of *nous*, the sleight of mind by which we are able to come to recognize particular things for *what they are*.

We began by suggesting that $(x)[Sx \rightarrow NecPx]$ represents the structure of some modal propositions. Perhaps, as we thought, that structure models the very mixture of particularity and necessity we've been looking at, as though the syllogism mirrored itself in the very structure of its proposition in ways we noted earlier. If so, the dual nature of modal propositions will seem not so egregiously an *ad hoc* hypothesis brought in to explain the difference in the validity of the two varieties of mixed modal syllogisms; the mixture of the modality of the syllogism will seem reflected in the mixture of the modality of the terms in the premises of the syllogism.

But perhaps this is fanciful, and the truth is simply that Aristotle allows different structures in order to explain the different forms of reasoning which he wishes to come out right. Perhaps he is merely ambivalent. But if Aristotle is ambivalent in his reading of the logic of necessity, it is not because of any obvious muddle in his modal thinking. It signals rather his principled refusal to countenance any easy Academic separation between the world and its intelligibility, or between entities and their essential being, and his insistence upon grounding all explanation and all understanding in the intelligible world of particulars rightly revealed.

This does not contradict Aristotle's claims that the particular cannot be understood. The reading I have suggested acknowledges Aristotle's insistence that they cannot be understood *qua particular*, but reminds us that in the act of understanding, the particular is apprehended into a general description in terms of which its features can be understood. Explanation, I have meant to claim, is directed ultimately to the particular, but to the particular revealed in terms of those general natures which explain its being, revealed most fundamentally in terms of *what it is*. As a consequence, the hybrid modes of reasoning figured in the *Prior Analytics* do not in themselves generate scientific understanding, nor do they form any part of a finished discursive science. Like the perishable particulars they serve to explain, they do not last, nor are they meant to last, since they serve to reveal the world for us and vanish after science teaches us to recognize the world for what it is.

On the other hand, the supposition that we might come to recognize the world for what it is an ideal vision of the regulative telos of science; in actual practice we remain situated in the world of the particular and

perishable, and therefore always in need of the intercession of the Barbaras of mixed nature. Unlike God, who dwells in the high and clean air of necessity, we continue to live in that peculiar mixture of necessity and contingency that is for Aristotle, as it was for the tradition he inherited, the distinctive climate of human being.²³

(23) A much earlier version of this essay was given at the University of Pittsburgh; I'm grateful for much helpful criticism then and during discussion at the Oléron conference. I have been particularly helped by the searching criticism of James Lennox.

ÉTUDE PRÉPARATOIRE À UNE INTERPRÉTATION DU SENS ARISTOTÉLICHIEN D'ΕΠΑΓΩΓΗ*

F. CAUJOLLE-ZASLAWSKY

La tradition est de rendre par « induction » le terme d'επαγωγή chez Aristote. Pourtant, cette traduction, qui, comme chacun sait, « a besoin d'être accompagnée d'explications »¹, ne peut satisfaire personne, ne serait-ce que par la façon dont elle privilégie indûment l'un des sens du terme — et, qui plus est, un sens qui n'entre peut-être même pas dans les diverses acceptions proprement aristotéliennes. Cependant, la difficulté ne consiste pas tant à déterminer ce qui sépare l'επαγωγή d'Aristote et l'induction moderne², qu'à comprendre l'usage aristotéli-

(*) Une première version de cet article a été présentée en juin 1987 aux Rencontres Internationales d'Oléron sur la Biologie d'Aristote, qui ont eu pour objet, cette année-là, du 29 juin au 3 juillet, l'étude des rapports entre méthode scientifique et métaphysique aristotéliennes.

(N. B. : les chiffres entre crochets droits renvoient aux ouvrages dont on trouvera la liste dans les Indications bibliographiques, à la fin de cet article).

(1) P. PELLEGRIN, *La classification des animaux chez Aristote*, Paris : Les Belles Lettres, 1982, pp. 141, 150, 180-3. L'auteur rejette, notamment, l'idée reçue d'une « construction inductive des familles animales » par Aristote en montrant que l'absence, dans sa méthode, d'observation ou d'expérimentation au sens scientifique du terme, fait qu'on ne saurait trouver chez lui d'« induction » proprement dite. La traduction d'επαγωγή par « induction » est, d'ailleurs, critiquée de même par la grande majorité des commentateurs. J. Hintikka, dans une formule qui semble résumer l'avis général, parle de « *translation highly misleading* », [9], p. 423. On conserve pourtant cette traduction traditionnelle, faute de trouver mieux. En fait, il ne s'agit pas réellement d'une traduction, mais d'une copie de copie : le latin a reproduit επαγωγή dans *in-ductio*, après quoi le français a fait de même avec *in-ductio*, « induction ». La forme du mot est transmise, mais le sens n'en est pas plus clair : « conduite sur », ou « vers », ou « contre », peut s'entendre de bien des façons.

(2) Selon T. Engberg-Pedersen [8], ce qui séparerait principalement l'επαγωγή de l'induction au sens où est pris aujourd'hui ce terme, c'est la présence, dans le cas de l'induction, d'un critère de validité : l'induction moderne contiendrait l'idée d'une

cient lui-même, qui se perd au travers d'une multiplicité de sens disparates — «convaincre par des exemples» et «inférer le principe général» constituant, de l'avis le plus répandu, la divergence sémantique essentielle —, pluralité qu'on méconnaît d'emblée en rendant uniformément le terme par «induction». Il faut donc commencer par restituer en toute clarté le phénomène des acceptions multiples du terme chez Aristote. La question pourra se poser ensuite de savoir s'il s'agit là d'une diversité superficielle masquant une unité latente, ou d'une disparité fondamentale — question souvent débattue, mais qui, visiblement, reste ouverte³.

Notons d'abord que la diversité de l'usage aristotélécien ne fait que refléter celle de l'usage courant, dans lequel se rencontre déjà, en effet, une profusion de nuances. Elles viennent différencier — la construction syntaxique et le contexte aidant — un sens général peu déterminé. C'est que le verbe *ἐπάγειν* a un sens général si large (*mener à*) qu'il peut, en effet, s'appliquer à des situations multiples et s'adapter aux domaines les plus divers, en revêtant des sens très éloignés les uns des autres.

On distingue ainsi⁴ un premier sens, où *ἐπάγειν* signifie *apporter* quelque chose, l'*apporter à* quelqu'un par exemple, ou bien à un endroit déterminé, ou encore *sur (contre)* quelqu'un ou quelque chose, ou *amener* quelqu'un *sur* ou *contre* quelque chose, *amener* quelqu'un à quelque chose, *appliquer* quelque chose à quelqu'un, à quelque chose⁵. En un

conséquence, c'est-à-dire d'une inférence, du particulier à l'universel, ce qui entraînerait la nécessité d'une validation du procédé inductif; au contraire, il n'y aurait aucun mouvement d'inférence dans l'*ἐπαγωγή*, même dans les *Analytiques premiers*, II 23.

(3) Engberg-Pedersen [8] distingue six sens d'*ἐπαγωγή*, qu'il tente de réunifier. Hintikka [9] propose, quant à lui, de réunifier en tout cas les sens où le terme désigne une manière de connaître les prémisses d'une science.

(4) Nous avons suivi, en gros, LIDDELL/SCOTT/JONES, *A Greek-English Lexicon* (réimp. 1973), mais, d'une façon générale, les usages poétiques n'ont pas été retenus, cependant que de nouveaux exemples étaient ajoutés, utiles à notre recherche. Pour ces compléments, on a utilisé les ouvrages suivants : H. BONITZ, *Index Aristotelicus*, Gratz : Akad. Verlag, 1955² (Berlin, 1870); J. E. POWELL, *A Lexicon to Herodotus*, Hildesheim : G. Olms, 1977 (reprod. Cambridge 1938), p. 126, art. *ἐπάγω, ἐπαγωγός*; E. DES PLACES, *Lexique de la langue philosophique et religieuse de Platon*, t. XIV de Platon, *Œuvres complètes*, Paris : les Belles Lettres, réimp. 1970 (1964), 2 vols; K. JANACEK, *Indices*, vol. IV des *Sexti Empirici Opera*, Leipzig : Teubner, 1970; A. BELIS, *Aristoxène de Tarente et Aristote : le traité d'harmonique*, Paris : Klincksieck («Études et commentaires» : 100), 1986, pp. 212-215, *ἐπαγωγή*. Le texte d'Aristoxène est celui de M. MEIBON éd. *Antiquae Musicae Auctores Septem*, vol. I, *Elementa*, pp. 1-74, Amsterdam, 1652 (avec traduction latine et notes).

(5) Τὸν ἵππον ἐ. : Hérodote, C. Hude éd., Oxford (OCT) : 3, 85; κινδύνους τινα : Isocrate, F. Blass éd., Leipzig : Teubner, 1889-98, 8, 3; *amener* des chiens *sur* la trace du gibier : XÉNOPHON, *Cynégétique*, 10.19 : -moy. *ib.*, 6, 25; *conduire* une armée *contre* l'ennemi : τινὰ ἐπὶ πᾶσι, Thucydide, H. Stuart Jones, Oxford (OCT) : 8.46; d'où *attaquer* (absolument, Hérodote 1, 63; 7, 157, 165; 8, 112); *presser* le mouvement, *accélérer* : PLATON, *Cratyle*,

second sens, *ἐπάγειν* au moyen signifie, d'une façon générale, *se procurer, pourvoir à (...)* pour soi-même, qu'il s'agisse de ressources, d'alliés, de témoins, d'une aide ou d'un secours quelconques. On retrouve donc, au moyen, certaines des acceptions que nous avons relevées pour la forme active du verbe⁶.

Pour le substantif d'*ἐπαγωγή* maintenant, il signifie globalement toute *action d'apporter* quelque chose, *d'apporter à*, ou l'*action de mener ou amener* quelqu'un à — un sens général qui se monnaie en une multiplicité de nuances particulières : l'*action de faire venir à son aide* (on amène à soi) mais aussi l'*invasion* et l'*attaque* (on apporte la guerre, on mène une armée sur) ou alors l'*alliance*, la *séduction*, l'*attrait* (une autre façon de mener à soi) ou encore l'*incantation*, la *formule d'envoûtement*, le *sort*, le *maléfice*, le «*charme*» (une menée contre ou l'acte d'orienter sur) ou enfin la *déportation d'un captif en esclavage, en captivité* (sans doute au sens d'une prise de guerre que le vainqueur «apporte» chez lui), d'où, plus généralement, *délresse* et *misère* (sens dérivé, qui n'a plus grand-chose à voir avec le sens initial)⁷.

On a donc affaire à un usage courant d'une extrême richesse, d'où il ressort en particulier que le terme possède, par son indétermination même, une capacité sémantique hors du commun. C'est donc le contexte

420 D; θάττονα ῥυθμὸν ἐ., XÉNOPHON, *Banquet*, 2, 22; *mener* quelqu'un par son *influence* : Thucydide, 1, 107; avec l'inf., *inciter* quelqu'un à faire quelque chose : Isocrate, 14, 63; *invoyer* l'aide ou l'alliance de quelqu'un, *faire entrer* quelqu'un dans une alliance, le prendre pour allié (τὸν Πέρσην, Hérodote 9, 1; τὸν Πέρσην ἐπὶ τοὺς Ἕλληνας, DÉMOSTHÈNE, *Lettre de Philippe*, 12, 7); *faire venir, procurer* (ἐπιτήδεια, Thucydide 7, 60; τὰ ἐκ τῶν διαρῶν ἐ. νάματα, PLATON, *Critias*, 118 E; métaphoriquement, *ἐπάγει ἡ ψυχὴ τὸ ἐν ἄλλῳ*, Plotin 6.9.1); *étendre* ou *allonger sur, appliquer à* (πληγὴν ἐπὶ τινα : *La Septante, Isaïe*, 10, 24; ἐ. ζῆμιαν = ἐπιτίθεναι : LUCIEN, *Anacharsis*, 11; ἐ. τὴν διάνοιάν τινα, PLUTARQUE, *Périclès*, 1); un usage comparable à l'usage platonicien du verbe *ἐπιφέρειν*.

(6) Ἐκ θαλάσσης ὧν δέονται ἐπάξονται : Thucydide, 1, 81; τὴν τῶν συμμάχων δούλωσιν *Id.* 3, 10. οἰκιστὴν ἐπὶ τὴν χώραν, *faire venir* un colonisateur dans la région, Hérodote 6, 34, 36; *invoyer* une divinité tutélaire, *Id.*, 1, 67; 5, 67); *invoyer* le témoignage, *prendre à témoin* : μάρτυρας ποιητὰς ἐ., PLATON, *République*, 364 C, *Lois*, VII 823 A; ARISTOTE, *Métaphysique*, 995 a 8; *attirer à soi, évoquer* au moyen de citations : ἐ. ποιητὰς ἐν τοῖς λόγοις, PLATON, *Protagoras*, 347 E; τὸν Ἡσίοδον μάρτυρα, *Lysis*, 215 C; ἐ. μαρτύρια, XÉNOPHON, *Banquet*, 8, 34; εἰκόνας ἐ., *Économique*, 17; *apporter* pour soi, *amener* pour soi, *faire venir* pour soi : νόκτα ἐν μεσημβρία, PLATON, *Lois*, X 897 D; φθόνον, XÉNOPHON, *Apologie de Socrate*, 32; συμφορὰν ἐμαντῶ, *Lysias*, C. Hude éd., Oxford (OCT) : 4, 19; αὐθαίρετον αὐτοῖς δουλείαν, Démosthène, 19, 259; πράγματα, *Id.*, 54, 1; εἰς αὐτοῖς δεσπότην ἐ. τὸν νόμον, PLATON, *Gorgias*, 492 B; μητρικὴν ἐ. κατὰ τῶν ἰδίων τέκνων, Diodore de Sicile, 12, 12; *ramener à soi, retourner* en sa faveur : τὸ πλῆθος, Thucydide, 5, 45; τινὰ εἰς εὐνοίαν, Polybe, 7, 14.4.

(7) Ἐπαγωγή τῶν ἐπιτηδείων : Thucydide 5, 82, 7, 24; τὴν τῶν Ἀθηναίων ἐ., *Id.*, 3, 100; ἐπὶ τοὺς ἐναντίους : Polybe 10, 23, 7; absolument : *Id.* 11, 15, 7; ταῖς ἐλπίσι καὶ ταῖς ἐ., Démosthène 19, 322; au pluriel, Platon, *ἐπαγωγαῖς* τισιν καὶ καταδέσμοις, *République*, II 364 C 4; καταδέσσειν ἢ ἐπαγωγαῖς ἢ τισιν ἐπὶ φασί, *Lois*, XI 933 D 7; Ἐκάτης φάσκων ἐπαγωγὴν γεγενῆσθαι, THÉOPHRASTE, *Caractères*, 16, 7.

qui, en chaque occurrence, va être décisif pour déterminer le sens précis. Ainsi, le terme signifie l'attrait, la séduction, dans le vocabulaire amoureux, l'absorption de nourriture dans le vocabulaire biologique, l'insertion de jours intercalaires dans le vocabulaire chronologique, l'induction au sens médical (l'induction au sommeil par exemple) dans le vocabulaire de la pharmacologie, l'appel à témoin ou, suivant le cas, l'introduction d'un témoignage, dans le vocabulaire juridique, la présentation d'un nouveau membre à une assemblée dans le rituel politique, l'incantation dans le vocabulaire de l'occultisme, l'importation dans le vocabulaire commercial. Mais il faut même, parfois, au sein d'un seul domaine, restreindre encore le champ et déterminer des sous-contextes, si l'on veut saisir adéquatement l'acception du terme. Car, dans le vocabulaire militaire, par exemple, il signifie l'invasion, tout en désignant aussi, d'un point de vue tactique, une formation particulière d'attaque⁸, et il signifie en outre, toujours dans le contexte guerrier, mais dans la perspective de l'intendance, l'apport de subsides ou de vivres, et dans une perspective stratégique, l'acquisition d'un allié; enfin, nous l'avons vu, il signifie, également, la déportation des prisonniers.

Le terme nous promène donc, en gros, de l'invocation d'un témoignage à l'invocation maléfique, de l'introduction à l'invasion en passant par l'intrusion, de l'importation à la déportation et de l'induction au sommeil à l'induction logique à travers l'induction à l'erreur et l'induction à mal faire. On voit la place considérable qu'il faudra faire, en conséquence — et même si nous pouvons d'emblée écarter un certain nombre des acceptions ci-dessus pour l'ἐπαγωγή qui nous occupe ici —, au travail d'interprétation. Le contexte, en effet, ne

(8) Dans la langue militaire, l'ἐπαγωγή fait référence à une formation tactique particulière, dans laquelle une aile est disposée à la suite de l'autre par contraste avec la formation appelée παραγωγή (ASCLÉPIODOTE [le tacticien], *Aeneas tacticus*, *Asclepiodotus*, *Onosander*, W. A. Oldfather ed., Collection Loeb, 1923, 10.1, 11.24). D'autre part, l'ἐπαγωγή désigne, dans le domaine biologique [en dépendance du sens du verbe : apporter quelque chose à un endroit particulier (μαζαι... τοὺς λίθους ἐπιηγόν, Thucydide, 1. 93) qui, au moyen, s'applique, par exemple, aux racines qui font entrer, tirent la nourriture à l'intérieur d'une plante (THEOPHRASTE, *Histoire des plantes*, 1.1.9), et se retrouve, analogue, au passif (τροφὰ ἐπάγεται τῷ σώματι, Timée de Locres, C. F. Hermann ed., Leipzig : Teubner, 1852 : 102b) l'absorption de nourriture par le gosier (ainsi chez ARISTOTE : de *Spiritu*, 483a9), mais aussi la direction dans laquelle se fait une pousse, celle des cheveux, par exemple, ἡ τῆς τριχὸς ἐπαγωγή (Diodore de Sicile, 3. 35); en médecine, le verbe ἐπάγειν signifie induire au sens d'entraîner, de provoquer : ἐπάγειν τὴν κοιλίαν (DIOSCORIDE, *De Materia Medica*, 4. 157, M. Wellmann ed., Berlin, 1906-1914, *varia lectio* pour ὑπάγειν). Cf., chez Platon, l'adjectif ἐπαγωγός, au sens médical de « adducteur » ou « inducteur » ἐπαγωγὸν ὕπνου, *Timée* 45 D 7. Enfin, en liaison avec le sens apporter en supplément, en sus d'ἐπάγειν, on a le sens technique particulier : intercaler des jours (πέντε ἡμέρας, Hérodote 2, 4; αἱ ἐπαγόμεναι, avec ou sans ἡμέραι, les jours intercalaires, DIODORE DE SICILE, I. Bekker et al. eds., Leipzig : Teubner, 1888-1906 : 13).

pourra, éventuellement, trancher du sens de façon décisive que s'il est d'abord établi lui-même avec exactitude. Et c'est précisément ce point qui, selon nous, constitue la première difficulté pour comprendre le sens d'ἐπάγειν et d'ἐπαγωγή chez Aristote. Car il ne suffit pas de déterminer si ces mots prennent sens dans un contexte logique, épistémologique ou pédagogique : il faut tenir compte de leur possible évolution sémantique, afin de ne pas projeter dans les écrits aristotéliciens une acception plus tardive. Il est donc nécessaire de faire intervenir aussi l'aspect historique du contexte.

Dans cette dernière perspective, il nous faut signaler un témoignage de Sextus Empiricus concernant l'ἐπαγωγή. L'intérêt de son texte est de nous montrer que le privilège accordé au sens de « généralisation par induction » pour ἐπαγωγή — s'il reste à vérifier la présence effective de ce sens chez Aristote lui-même — apparaît bien installé dans l'usage post-aristotélicien. Le sens « induction » semble, en effet, fixé depuis longtemps en logique, à la façon dont Sextus Empiricus le commente : « Donc, la prémisse 'tout homme est un animal' tire sa certitude, inductivement, des cas particuliers : car, du fait que Socrate est un homme et un animal, et qu'il en est de même pour Platon, ainsi que pour Dion et pour chaque exemple particulier, il semble possible d'affirmer aussi en toute certitude que tout homme est un animal. Par suite, si un cas particulier, même unique, apparaît contraire aux autres, la prémisse universelle n'est pas valide ; c'est-à-dire que, par exemple, puisque chez la plupart des animaux c'est la mâchoire inférieure qui est mobile, et la mâchoire supérieure seulement chez le crocodile, la prémisse 'tout animal a la mâchoire inférieure mobile' n'est pas vraie. Donc, quand on dit 'tout homme est un animal, or Socrate est un homme, donc Socrate est un animal', en voulant tirer, de la prémisse universelle 'tout homme est un animal', la prémisse particulière 'donc Socrate est un animal', laquelle, en fait, sert à assurer la prémisse universelle par le procédé inductif, comme nous l'avons rappelé, on tombe dans le diallèle, la prémisse universelle étant assurée par chacune des particulières qu'on tire syllogistiquement de l'universelle.

Il en va à peu près de même pour un raisonnement tel que 'Socrate est un homme, or aucun homme n'est un quadrupède, donc Socrate n'est pas un quadrupède' : en voulant faire inductivement l'assertion de la prémisse 'aucun homme n'est un quadrupède' en partant des particulières, et tirer syllogistiquement chacune des particulières de la prémisse 'aucun homme n'est un quadrupède', on tombe dans le piège du diallèle (*Hypotyposes pyrrhoniennes* II, 195-197)⁹.

(9) SEXTUS EMPIRICUS emploie, d'une part, la forme ἐπαγωγικός, inductif (généralisant) : *Hypotyposes pyrrhoniennes*, II 196 (δ ἔ. τρόπος), 213 (ἐπαγωγική ἐπιστήμη); *Contre les professeurs*, IX 95 (δύναμις ἐπαγωγική); et ἐπαγωγικῶς (au sujet des propositions établies de manière inductive) *HP* II 195 = 197 (ἐπαγωγικῶς βεβαιῶ). Il emploie également le

Curieusement, cette image de l'ἐπαγωγή, dont on peut dire d'emblée — même en ignorant le sens exact du terme chez Aristote — qu'elle ne saurait refléter aucun usage aristotélicien (d'ailleurs, Sextus Empiricus ne commet pas l'erreur d'attribuer au Stagirite l'absurdité qu'il décrit) est devenue ensuite dans l'opinion le type même du raisonnement dit « aristotélicien » (syllogisme et « induction », pêle-mêle), et le texte de Sextus se trouve de même à l'origine des fameuses « critiques », aussi incongrues qu'obstinées, de la prétendue circularité du raisonnement aristotélicien.

Comment prétendre, cependant, qu'Aristote a voulu « faire inductivement l'assertion de la prémisse 'aucun homme n'est un quadrupède' en partant des particulières » ? Dans une perspective aristotélicienne, une telle chose n'a pas le sens commun. Il n'est pas question, pour Aristote, de passer tous les cas en revue, ni même un grand nombre d'entre eux, et — avant toute autre raison — parce que cela impliquerait de traiter à égalité l'accidentel et l'essentiel : il faudrait compter les pieds d'un animal sans considération du fait que son nombre de pieds est dû ou non à un accident. On établirait des colonnes : nombre d'hommes à un pied, nombre d'hommes à deux pieds, nombre d'hommes à trois pieds, etc. Or, avoir deux pieds, pour un homme, cela n'a pas la même signification que d'en avoir un ou pas du tout (dans les deux cas, il s'agit d'une privation, et le résultat d'une privation ne peut être compté comme un équivalent de l'état normal), pas plus que d'en avoir trois ou quatre. Non point qu'être bipède soit un caractère essentiel, qui entre dans la définition de l'homme ; car, si un homme se trouve accidentellement être né avec quatre pieds, cela n'en fait nullement un quadrupède (sauf à jouer sur les mots), pas plus que cela ne rend fausse la proposition « aucun homme n'est un quadrupède » : pour Aristote, un homme qui aurait quatre pieds serait simplement un homme atteint d'une malformation. Bref, avoir deux pieds ferait, dans le cas de l'homme, partie de ce qu'Aristote appelle les propriétés qu'on possède en vertu de soi, mais « par voie de conséquence »¹⁰ — comme d'être égal à deux droits pour le triangle : c'est une propriété par soi, mais *déduite* (et non pas « induite »).

substantif : *HP* II xv 204 : περί ἐπαγωγῆς, τὸν περί ἐπαγωγῆς τρόπον, procédé dont il décrit l'intention de la sorte : « ἀπὸ τῶν κατὰ μέρος πιστοῦσθαι βούλονται δι' αὐτῆς τὸ καθόλου ». Voir aussi : *Ibid.*, ch. xvii (περί διαιρέσεως) 213 : « Ἐπεὶ δὲ τινες τῶν δογματικῶν τὴν διαλεκτικὴν εἰναί φασιν ἐπιστήμην συλλογιστικὴν ἐπαγωγικὴν ὁριστικὴν διαιρετικὴν... », et *HP* II 195-197 (qu'il serait instructif de comparer avec *Analytiques premiers* II 22-23). De là, ensuite, le sens : συλλογισμοὺς ἢ ἐπαγωγὰς περαινοντας, chez Polyste l'Épicurien (C. Wilke ed., Leipzig : Teubner, 1905, p. 11), sens qu'on trouve aussi chez Plotin (par exemple, 2.46 etc.). De là, également, le sens de *raisonnement dialectique*, entendu comme étant destiné à conduire l'adversaire dans un piège (chez Aulu-Gelle, par exemple, 6 (7).3.35 ; ou Diogène Laërce, III 53).

(10) Nous faisons allusion à la notion de συμβεβηκότα καθ' αὐτά. Cf. *Métaphysique* B, 997a7 ; Δ, 30, 1025a30-35 ; Z, 4, 1029b16-23.

Le texte de Sextus Empiricus, tout en nous indiquant l'évolution du terme, fait apparaître que l'induction ainsi comprise ne saurait être celle d'Aristote.

On considère généralement que, dans la logique d'Aristote, ἐπάγειν signifie *enseigner* ou *convaincre par induction* ; mais le verbe semble signifier également : *mettre en avant, avancer*, d'où *inférer* le principe général¹¹. Quant à l'ἐπαγωγή, on l'interprète donc, dans les textes d'Aristote, au sens de *raisonnement inductif*, « induction », en se fondant sur la description aristotélicienne la plus connue de l'ἐπαγωγή : ἐπαγωγή ἡ ἀπὸ τῶν καθ' ἕκαστον ἐπὶ τὰ καθόλου ἔφοδος¹², qui est, en effet, la seule sur laquelle on puisse se fonder pour tenter de défendre la traduction « induction ». L'ἐπαγωγή serait donc un passage, une voie d'accès (ἔφοδος), qui mènerait, depuis les cas individuels, aux cas universels. Notons que ce sens, où l'ἐπαγωγή s'oppose au syllogisme en tant qu'il est un raisonnement déductif (d'où, par contraste, la traduction d'« induction » pour « ἐπαγωγή ») est le sens qui, par la suite, prévaudra, comme l'indique l'emploi, ci-dessus mentionné, du terme chez Sextus Empiricus.

Ce qui nous intéresse, ici, est d'observer de quel passage il s'agit exactement et en quoi il consiste. C'est qu'Aristote dit ailleurs, en effet, de la même ἐπαγωγή qu'elle est le principe, le point de départ (ἀρχή) de l'universel¹³. Et nous avons là une première divergence entre deux sens, dans la relation de l'ἐπαγωγή à l'universel : un « passage » est un processus, et ce n'est donc pas une base de départ, mais ce qui a lieu entre point de départ et point d'arrivée. L'ἐπαγωγή est-elle ce dont on part pour atteindre l'universel ou bien l'une des voies qu'on emprunte pour accéder à l'universel ?

Essayons de suivre, tour à tour, les deux directions et voyons où chacune d'elles va nous mener. Commençons par explorer la voie où la notion d'ἐπαγωγή se trouve liée à celle de principe. Or, sur cette piste,

(11) Présenteraient le premier sens les passages : *Topiques*, VIII, 1, 156a4 ; au passif : *Analytiques Seconds*, I, 18, 81b5 ; cf. I, 1, 71a21, 24 ; absolument : *Rhétorique*, 1356b8 ; *Topiques*, VIII, 2, 157a18-21 sqq ; 14, 164a12-13 ; *Analytiques Seconds* II, 5, 91b15. Le second sens se trouverait, par exemple, en *Topiques*, I, 18, 108b11, etc. De là paraît venir le sens que ce verbe prendra par la suite : *ajouter une raison, conclure, inférer*.

(12) *Topiques*, I, 12, 105a13. Pour l'ensemble des textes d'Aristote relatifs à l'ἐπαγωγή, voir H. BONITZ, *Index Aristotelicus*, pp. 263-4. Voir également W. D. ROSS (*Aristotle*, Londres, 1923, 1949⁶, pp. 38-41 ; et l'édition des *Analytiques*, Oxford, 1949, pp. 47-51 et 481-483) et les notes ainsi que l'introduction, de J. BRUNSCHWIG à son édition des *Topiques* I-IV, [*Aristote, Topiques*, T. I, L. I-IV, Paris : les Belles Lettres, 1967 ; notamment pour les passages : *Topiques* I, 8, 103b1-19 ; 12, 105a10-20 « Dédution et induction » ; II, 8, 113b17, 29 (ἀνάπαυ) ; 10, 115a5-6 (si l'accroissement du sujet entraîne celui de l'accident, l'accident appartient au sujet) ; IV, 2, 122a19 (autre cas montrable par ἐπαγωγή) ; 3, 123b7-8 ; et pp. xxxii, n. 2 ; 125 (p. 12, n. 1) ; 137 (p. 32, n. 1) ; 149-150 ; 153 (p. 57, n. 2) ; pour la déduction : 100a25 et notes, pp. 113 ; 125 (p. 12, n. 2)].

(13) *Éthique à Nicomaque*, VI 3 1139b28, par exemple.

survient une indication qui ne clarifie pas les choses, celle que, parmi les principes, certains sont pris en considération au moyen d'une *ἐπαγωγή* (*ἐπαγωγή*), d'autres par une sensation (*αἰσθήσει*)¹⁴. Nous voilà donc avec une *ἐπαγωγή* qui n'est plus un principe, ni d'ailleurs un processus, mais un acte simple de voir les principes (*θεωρεῖν*). Et de plus, cette «vision» est présentée comme n'étant pas d'ordre sensible; elle s'apparenterait alors à une sorte d'intuition intellectuelle¹⁵. Principe ou intuition des principes? Nous voilà dans l'impasse.

Mais, ce premier essai, pour être infructueux, nous a cependant permis d'observer la répétition d'un certain schéma : en deux occurrences successives, l'*ἐπαγωγή* est apparue comme se rapportant de deux façons incompatibles à une notion centrale. Dans le premier cas, la notion est celle d'universel : l'*ἐπαγωγή* a trait à l'universel, mais tantôt comme son principe et tantôt comme sa voie d'accès. Dans la seconde hypothèse, l'*ἐπαγωγή* a trait à la notion de principe, mais tantôt elle est un principe elle-même, et tantôt elle est l'intuition des principes. Essayons de réduire autant que possible ces contradictions. Un moyen de le faire serait éventuellement de comprendre ainsi les choses : l'*ἐπαγωγή* serait principe de l'universel au sens de point de départ, c'est-à-dire d'opposé. Ce serait, dans cette perspective, la sorte de particularité qui donnerait accès à l'universel (car toute forme de particularité n'est pas apte à le faire). Et peut-être la nature particulière du point de départ impose-t-elle aussi une voie particulière d'accès à l'universel : le point commun à l'*ἐπαγωγή* comme base de départ et processus serait sa particularité, laquelle constituerait, en l'occurrence, le trait le plus caractéristique de l'*ἐπαγωγή*. Il reste à trancher pour elle entre la nature d'origine ou de processus.

Appliquons le même traitement à la seconde contradiction : «principe de l'universel» ou «intuition des principes»? L'opposition se réduirait si l'on substituait à la désignation trop vague de «principe» ses deux acceptions précises, celle de commencement et celle de commandement : l'*ἐπαγωγή* serait *point de départ* vers l'universel comme intuition d'une *règle*. L'indication du caractère de particularité se retrouve ici dans la mise en parallèle avec la saisie par la sensation — qui est l'autre façon de saisir ce qui est d'ordre particulier.

Notre hypothèse est donc que l'*ἐπαγωγή* est la vision, non point sensible mais intellectuelle¹⁶, l'intuition intellectuelle, sur la base d'éléments particuliers (rien n'empêche qu'ils soient eux-mêmes sensibles), de quelque chose qui n'est plus particulier. Mais il faut, pour

(14) *Éthique à Nicomaque*, I, 7, 1098b3.

(15) Voir, sur l'«intuition» chez Aristote, L. A. Kosman [5] (analyse de l'intuition comme «*insight*»), et L. Couloubaritsis [10].

(16) Sur le rôle précis de *νοῦς* à cet égard, voir Couloubaritsis [10].

évacuer toute contradiction, que cette intuition puisse, sans être un processus, donner accès à l'universel. Ou alors, il faut imaginer que cette intuition, qui fait accéder à l'universel, si elle est un point de départ relativement à ce dernier, est en même temps située au terme d'un processus. Cette intuition ne serait pas immédiate, mais provoquée, consécutive à une recherche, à un apprentissage. Ce serait, par exemple, à un certain stade de la réflexion, la découverte, l'intuition au sens de vision intellectuelle (compréhension claire, restructuration soudaine) d'une forme conceptuelle évidente, ou d'une règle. Aristote pourrait avoir désigné du même terme la démarche méthodique procédant par les cas particuliers concrets et le couronnement intuitif de ce type d'approche.

L'*ἐπαγωγή* serait donc, dans cette hypothèse, à la fois un processus menant à un acte instantané d'intuition (la perception mentale d'un universel, par exemple d'une règle applicable à tout cas particulier de même sorte), un procédé (la méthode qui s'appuie sur le comportement des cas particuliers concrets), un point de départ vers l'universel (différent de l'établissement des prémisses du syllogisme).

On voit qu'il est donc possible, dans ces conditions, d'interpréter l'*ἐπαγωγή* dans différents contextes : dans une perspective pédagogique, elle peut consister à faire passer un élève d'un état d'ignorance à un savoir, ou bien à passer rationnellement et dans une perspective épistémologique, de la validité de propositions particulières à l'assertion d'une proposition universelle¹⁷.

(17) La première interprétation est celle, notamment, de K. von Fritz [2], qui rapproche l'*ἐπαγωγή* de la maïeutique telle que la pratique Socrate auprès du petit esclave du *Ménon* : «*ἐπαγωγή*», c'est-à-dire «introduction» (*Heranführung*) au sens le plus élémentaire de ce mot; mais il y a aussi des cas de conduite de la preuve (*Beweisführung*) dans lesquels entrent les éléments de la déduction au sens moderne. Cela est particulièrement clair dans les cas mis en avant par PLATON, dans le *Ménon* (82B sq.), où Socrate conduit l'esclave inculte — et cela en l'introduisant (*heranführt*) au problème avec l'aide d'une figure dessinée — à parvenir par lui-même, après plusieurs essais infructueux, à admettre que, si l'on veut doubler la surface d'un carré, de façon que la surface doublée ait à nouveau la forme d'un carré, on doit obtenir le carré construit sur la diagonale (p. 201). ARISTOTE parle là (en *Rhétorique*, I, II, ch. 20, 1393a32sq.) de l'usage du paradigme dans la rhétorique, et il identifie cet usage à celui de l'épagogé dans la dialectique. Ici également il s'agit d'une «introduction» (*ein Hinführen*) des auditeurs à ce que l'orateur veut leur suggérer (p. 217). Mais déjà les deux termes techniques qui désignent les deux méthodes de s'assurer la certitude les plus originelles, *ἐπαγωγή* et *ἀπαγωγή*, désignent une «introduction dans» et un «éloignement de» (*Hinführen* et *Hinwegführen*), qui sont introduction et éloignement de celui à qui on veut communiquer et rendre contraignante une connaissance (p. 218).

On trouve la seconde interprétation, qui s'appuie essentiellement sur *Topiques* I 12, déjà chez Aulu-Gelle (VI iii 35, 44), ou SEXTUS EMPIRICUS (*Hypolyposes pyrrhoniennes* II 204); l'un et l'autre la présentent, d'ailleurs, comme si elle était, dans leur esprit, la seule conception qui existe du procédé d'*ἐπαγωγή*.

Et, s'il s'agit d'un procédé de ce genre, la question se pose du nombre de cas nécessaires à son bon fonctionnement : combien d'exemples faut-il pour convaincre ou pour généraliser ? Combien de cas particuliers sont-ils requis ? Et selon quel critère certains cas particuliers seront-ils choisis plutôt que d'autres¹⁸ ? Enfin — et nous nous en tiendrons là dans l'énumération des difficultés —, quel est le rapport exact de l'ἐπαγωγή au syllogisme ? Comment peut-elle s'opposer au syllogisme si, « d'une certaine manière », elle est un syllogisme elle-même¹⁹ ?

Nous nous proposons donc de revenir une fois encore sur cette notion évasive, mais en empruntant pour le faire une voie un peu détournée : celle d'une enquête qui, avant d'en venir à l'emploi du terme dans l'œuvre d'Aristote, porterait d'abord, d'une part sur son usage courant, d'autre part sur certains de ses usages techniques ou savants, chez d'autres auteurs qu'Aristote. Car ce dernier n'a pas créé le terme d'ἐπαγωγή, s'il est vrai qu'il en a marqué l'usage en se l'appropriant : il a trouvé le mot soit, directement, dans la langue ordinaire, soit l'a emprunté à un langage déjà spécialisé ; et ce terme a encore été utilisé après lui. L'intention du détour que je propose est de vérifier si d'éventuels usages d'ἐπαγωγή, indépendants ou différents de celui d'Aristote, ne pourraient nous rendre ce dernier plus clair.

Revenons un instant sur les acceptions courantes du mot ἐπαγωγή pour constater, en premier lieu, que la langue courante, contrairement à l'expression philosophique, ne met pas l'accent sur la notion et ne privilégie donc pas le substantif ἐπαγωγή, mais donne la préséance au verbe. Le sens global du composé ἐπ-άγειν est, littéralement, nous l'avons vu, « mener sur », et l'ensemble de ses acceptions particulières dans le langage courant est formé des interprétations variées auxquelles donne lieu la combinaison de ce verbe avec ce préverbe. Or, on sait que le préverbe ἐπ « n'est jamais susceptible de se vider de son sens propre. Exclusivement « plein », il conserve à peu près toutes les valeurs qui ont été indiquées (§ 522sq.) lorsqu'il a été étudié comme préposition : il n'y a guère de différence entre ἐπὶ βαίνω γῆς et βαίνω ἐπὶ γῆς²⁰. Le sens du

(18) Ce qui résoudrait la question de savoir s'il convient de séparer des autres textes relatifs à l'ἐπαγωγή ceux des *Analytiques* : une telle séparation n'est pas utile.

(19) L'ἐπαγωγή s'oppose au syllogisme en ce qu'elle n'est pas une démonstration : *μανθάνομεν ἢ ἐπαγωγῇ ἢ ἀποδείξει*, *Analytiques seconds* 81a40 ; « διδασκαλία... ἢ μὲν δι' ἐπαγωγῆς ἢ δὲ συλλογισμῶν », *Éthique à Nicomaque*, 1139b27 ; *ἔστι τὸ μὲν παράδειγμα ἐπαγωγῆς, τὸ δ' ἐνθύμημα συλλογισμῶς*, *Rhétorique*, 1356b3. Toutefois, elle ne s'oppose pas au syllogisme comme l'induction à la déduction : il y a, comme le signale avec raison von Fritz [2], un aspect incontestablement déductif dans l'ἐπαγωγή, cf. ci-dessus, n. 17 : « il y a aussi des cas de conduite de la preuve (*Beweisführung*), dans lesquels entrent les éléments de la déduction au sens moderne. » (p. 201).

(20) J. HUMBERT, *Syntaxe grecque*, Paris : Klincksieck, 1972³, p. 337, § 598 (le soulignement est de l'auteur lui-même). Les valeurs de ἐπ : *au sens concret*, ἐπὶ avec

verbe est dès lors intéressant pour éclairer celui du nom (à la différence de ἀναλογίζεσθαι, par exemple) et ce sens sera en outre indiqué, quand le verbe ne sera pas employé absolument, par le « cas » de ses compléments. Quant au substantif ἐπαγωγή, il présente une diversité de sens comparable à celle du verbe, à cette différence près — qui contribue d'ailleurs à obscurcir encore le sens philosophique du terme — que la valeur de ἐπ n'est plus indiquée comme elle l'était pour le verbe, par le « cas » d'un éventuel complément. Il faut désormais se contenter de la simple indication suivante : « ... ἐπ exprime avant tout l'image d'un contact avec une surface »²¹.

Ce point ayant été précisé, venons-en maintenant à l'étude d'un usage plus technique du terme.

Il a existé, en effet, avant Aristote, un usage qu'on pourrait qualifier de « pédagogique » des deux termes. On le trouve, notamment, chez Platon.

Dans un enseignement ou une argumentation, ἐπάγειν signifie, de façon générale, *conduire à* : par exemple, chez Platon, amener des élèves à percevoir ce qu'ils ne savent pas encore discerner, ou, chez Aristoxène de Tarente, amener les gens à percevoir, en le leur faisant écouter, la beauté d'un accord dont ils contestaient, *a priori* et sur un plan théorique, qu'il pût être harmonieux. Dans cette perspective, l'ἐπαγωγή est un procédé pédagogique consistant à instruire ou à convaincre quelqu'un en le confrontant aux évidences de la perception sensible²².

Notons, pour mémoire, que Platon emploie le terme d'ἐπαγωγή aussi bien dans certaines de ses acceptions courantes que dans un usage plus

l'accusatif signifie « vers » ; ἐπὶ avec le génitif signifie « sur » ; ἐπὶ avec le datif signifie « à côté de, contre ». Valeurs abstraites, au génitif (partitif) est liée l'idée d'autorité exercée sur quelqu'un ; au datif locatif de proximité sont liées les idées de survivance, d'adjonction, de cause, du datif proprement dit relève le fait qu'une action est accomplie « en faveur de » ou « au détriment de » quelqu'un (*adaliis commodi et incommodi*).

(21) HUMBERT, *Op. cit.*, p. 308. E. KAPP, comparant le ἐπὶ dans ἐπαγωγή et ἐπιλογισμός souligne qu'il n'a pas le même sens dans les deux cas. Dans ἐπιλογισμός, il signifierait « en sus », désignant un raisonnement qui vient après un autre ou en addition à un autre (dans *Ausgewählte Schriften*, Berlin : W. De Gruyter, 1968, pp. 285-290, reprod. d'un compte rendu de 1957).

(22) PLATON : *τινας ἐπὶ τὰ μῆπω γινωσκόμενα*, *Politique*, 278 A (nous reviendrons plus loin sur l'analyse de ce passage capital) ; ARISTOXÈNE DE TARENTE emploie la forme passive du verbe : « ἐπαχθέντων αὐτῶν », *Traité d'harmonique*, p. 23, 2^e éd. Meibom (voir ci-dessus, note 4) ; « ἐπαχθεῖσιν αὐτοῖς », *Ibid.* 23, 9. Il emploie également le substantif correspondant : « διὰ τὴν ἐπαγωγὴν δὲ τὴν ἐπὶ τοῦτο γινόμενῃ κατὰ τὸν χωρισμὸν τὸν ἀπὸ τῶν ἄλλων ἀναγκαῖον πως καὶ τῶν ἄλλων ἐπαφᾶσθαι φύσεων », *Traité d'harmonique*, préambule des *Principes*, p. 4, (l. 14-17) ; « διὰ τοιαυτῶν τινος ἐπαγωγῆς », *Ibid.*, *Éléments*, p. 53 (l. 21). Voir commentaire de A. BELIS, *op. cit.*, pp. 213-215. On constate de façon particulièrement claire sur ces derniers exemples que la traduction « raisonnement par induction » exige toute une réinterprétation.

technique et proprement philosophique. Il utilise en effet le terme, au pluriel et en association avec ἐπωδή²³ ou κατάδεσις ou encore κατάδεσμος, dans l'acception courante de « charme » magique, pour dire qu'un charme est « amené sur » une personne et pèse sur elle, la plaçant « sous l'influence » de quelque puissance occulte. Les exemples empruntés à Platon permettent dans une certaine mesure de préciser le sens du ἐπί contenu dans ἐπαγωγή : le terme est employé en association, notamment, avec ἐπωδή, qui a le même préfixe (καταδέσειν ἢ ἐπαγωγαῖς ἢ τισιν ἐπωδαῖς). Or, la valeur du ἐπί de ἐπωδή se trouve être clarifiée, dans certaines expressions, par le renforcement de ce préverbe au moyen de la préposition elle-même : ἐπωδή δέ τις ἐπὶ τῷ φαρμάκῳ²⁴. Nous rencontrons également chez Platon ἐπαγωγός, au sens usuel de « séducteur », et au sens technique médical de « adducteur » ou « inducteur » : ἐπαγωγὸν ὕπνου²⁵.

Maintenant, Platon emploie en un sens pédagogique bien précis la formule : ἐπάγειν τινας ἐπὶ τὰ μήπω γινωσκόμενα. Dans le passage du *Politique* où nous la trouvons (en 278 A), il est question de l'apprentissage de l'écriture. Platon part du stade où l'enfant a une perception suffisamment distincte (ικανῶς διαισθάνεσθαι; cf. *Phèdre* 250 B; *Sophiste* 253 B) de chacune des lettres dans les assemblages les plus courts et les plus faciles, et où il se montre capable de les y désigner correctement, mais où il reste encore hésitant quand il s'agit d'identifier ces mêmes lettres dans les assemblages plus complexes, et commet alors des erreurs d'appréciation aussi bien que d'expression. Or, dit Platon, le moyen le plus simple et le meilleur d'amener (ἐπάγειν) l'enfant aux choses qu'il ne sait pas encore discerner (ἐπὶ τὰ μήπω γινωσκόμενα) consiste à le ramener, pour commencer, aux cas simples, où il a identifié correctement les

(23) P. BOYANCÉ, *Le culte des muses chez les philosophes grecs*, Paris, 1937 (pp. 36-42); W. THEILER, dans *Festschrift... K. Meuli. Schw. Archiv für Volksk.*, XLVII, 1951, pp. 196-7.

(24) *Charmide* 155 E 5, E 7; 156 A 2, B 1, D 4; 157 A 4, B 4, C 4; 158 B 8; 175 E 2; 176 A 1; *Euthydème* 289 E 5; 290 A 1. Notons que l'usage de ἐπάδειν semble indiquer un sens assez voisin : ἐπαστέον πρὸ τῆς τοῦ φαρμάκου δόσεως, *Charmide*, 158 C 2 (cf. 155 E 6, 176 B 2); χρὴ τὰ τοιαῦτα ὥσπερ ἐπάδειν ἑαυτῷ, *Phèdon*, 114 D 7 (cf. 77 E 8; *République*, X 608 A 3; *Théétète*, 149 D 1, 157 C 9; *Lois*, II 665 C 4, 666 C 6); ἐπάδοντα... πείθειν πειραῖσθαι, *Lois* VI 773 D 6 (cf. VIII 837 E 6); ἐπάδη ταῖς τῶν νέων ψυχαῖς, *Lois* VII 811 C 6 (cf. II 664 B 4); τοιαῦτα παραμυθούμενος ἐπάδειν, *Lois* XII 944 B 3.

(25) « Séducteur » : αὐτῆς (τῆς ἡδονῆς) τὸ ἐπαγωγὸν γοήτευμα... εἶναι, *Philèbe*, 44 D 1; « inducteur du sommeil » : *Timée* 45 D 7. Les termes associés ou apparents aux précédents, chez Platon, sont les suivants : ἐπακτός, ἐπακτῷ παρ' ἄλλων... τῷ δικαίῳ... χρῆσθαι καὶ ἀπορίᾳ οἰκείων, *République*, III 405 B 2; μανίας... πληρώσει ἐπακτοῦ, *République*, IX 573 B 5; ἐπείσκατος, ἐπίκτητος. Il serait sans doute éclairant d'effectuer quelques études comparatives, et d'opérer certains rapprochements de termes, toujours dans la perspective de mieux cerner, par effets conjugués de ressemblance et de contraste, la valeur exacte du mot ἐπαγωγή : ἐπαγωγή et ἐπαναδασμός « échelon »; ἐπαγωγή et ἐπαναγωγή « élévations », « position élevée »; ἐπιδείγμα « échantillon », παράδειγμα « modèle » (cf. ARISTOTE, ἐστὶ τὸ μὲν παράδειγμα ἐπαγωγή, τὸ δ' ἐνθύμημα συλλογισμός, *Rhétorique*, 1356b3).

lettres, après quoi on placera en regard de ceux-là ceux qu'il ne perçoit pas encore distinctement, et on lui fera voir, par comparaison, qu'il s'agit de la même lettre dans deux combinaisons différentes, en recommençant le parallèle entre les assemblages qu'il interprète correctement et ceux qu'il ne sait pas analyser, jusqu'à ce que les premiers lui servent de modèle (paradigme) pour nommer — quelle que soit la lettre et l'assemblage où elle se trouve — différemment les lettres différentes et toujours identiquement la même lettre.

Il suffit d'une confrontation rapide de quelques passages relatifs à l'ἐπαγωγή pour discerner les divers éléments, conceptuels et terminologiques, qui la constituent ou lui sont attachés dans la pensée platonicienne. On notera d'abord l'importance capitale de la perception sensible dans ce type d'apprentissage. On fait travailler l'élève sur des objets concrets²⁶. Ce n'est pas un hasard si tout le passage est une réflexion sur la notion d'exemple (παράδειγμα). D'où la nécessité de provoquer chez l'élève une prise de conscience de ce qu'est un exemple, un modèle. L'enseignement consiste en premier lieu à donner à l'apprenti les moyens d'analyser en lui un παθος²⁷, et cela en lui révélant un donné (inné ou déjà acquis), qu'il ignorait jusque-là avoir en sa possession, qui lui servira désormais de paradigme — c'est-à-dire auquel il se référera pour analyser, comparativement, les nouveaux objets²⁸. Un apprentissage à travers le sensible, les images sensibles et les perceptions sensibles²⁹. L'enseignement se fonde principalement sur la perception et a pour intention d'augmenter et d'affiner la perception des choses.

En accordant cette prérogative aux perceptions, Platon ne signifie pas qu'il rejette de l'apprentissage le raisonnement : simplement, il lui donne pour objet, non point des réalités abstraites, propositions ou concepts, appartenant à l'ordre du discours, mais des perceptions — dont la vertu sera d'être, grâce à lui, le plus concrètes possible. Le raisonnement sert, ici, à améliorer en l'exerçant la capacité de percevoir les choses, et de ce fait, il apparaît subordonné aux fins de la sensibilité — ce qui pourrait sembler étonnant chez Platon. L'exercice rationnel

(26) Le vocabulaire utilisé par Platon pour exposer la méthode « épagogique » s'appliquerait aisément au domaine musical (διαισθάνεσθαι διάστημα, συλλαβή). Les lettres sont perçues comme des sons avant de l'être comme des signes abstraits, et la « syllabe » est une combinaison de sons, un accord au sens technique du terme (à l'origine, la συλλαβή est, en musique, l'accord de quarte).

(27) *Phèdre*, 250 B; *Politique*, 277 D.

(28) Tout cela n'est pas sans suggérer quelque rapprochement avec la théorie de la Forme (*Gestalt*) : inventer un paradigme revient à découvrir une « bonne forme », une forme « prégnante ».

(29) Διὰ τῆς ἐναργεστάτης αἰσθήσεως, ἐναργὲς εἶδωλον (*Phèdre*, 250 D); le choix des verbes (γινώσκειν, ἐνδεικνύειν, δειχθῆναι, δειχθέντα : *Politique*, 278 A-B) est également révélateur du fait : Platon a dans l'esprit un type de connaissance essentiellement fondé sur la sensation.

auquel est soumise la perception consiste en un travail de comparaison entre des perceptions, et de référence de la perception confuse à la perception claire³⁰. Or, au terme de ce travail se produit ce qu'en empruntant la formule de Piaget on pourrait appeler «une brusque restructuration» : à force de répéter le même mouvement de va-et-vient on voit que quelque chose est un modèle³¹.

Mais l'ἐπαγωγή platonicienne ne semble pas s'être limitée à cette application pédagogique.

Nous disposons, en effet, concernant l'usage de l'ἐπαγωγή par Platon, un témoignage fort intéressant de Diogène Laërce, aux §§ 53-55 du Livre III des *Vies*. L'intérêt du passage tient principalement au fait que l'auteur, attribuant, et à juste titre, à Platon l'usage d'un procédé méthodique qui se nomme ἐπαγωγή, place sous cette dénomination, non point le procédé pédagogique que Platon lui-même a nommé ἐπαγωγή, mais un certain procédé logique qui, certes, a pu être utilisé par Platon, mais qui ne l'a pas été, en tout cas, sous le nom d'ἐπαγωγή³². Ce procédé logique, ainsi décrit par Diogène «ἔστι μὲν γὰρ ἐπαγωγή λόγος διὰ τινων ἀληθῶν τὸ ὁμοιον ἑαυτῷ ἀληθὲς οἰκείως ἐπιφέρων», possède, d'après lui, le trait particulier de pouvoir servir, suivant le tour (τρόπος) qu'on lui donne, aussi bien à la démonstration d'une thèse qu'à sa réfutation. Il existe, en effet, deux modes d'utilisation de l'ἐπαγωγή. L'un procède par contrariété, et se trouve ainsi destiné à la réfutation des thèses adverses³³ : mais le second, qui procède de la concordance, est utilisé par Platon pour établir ses propres thèses³⁴. Ce mode se subdivise lui-même en deux, comportant en effet une application dite «rhétorique» et qui se limite au champ du particulier³⁵, cependant que l'autre application, «dialectique», a affaire à l'universel.

Ce mode dialectique procède de la façon suivante : la thèse qu'il s'agit d'établir est présentée sous forme interrogative (par exemple : l'âme est-elle immortelle?); pour la démontrer, on a recours à une proposition universelle (à savoir : «les contraires procèdent des contraires») : mais cette proposition universelle, pour sa part, a été établie à partir de faits particuliers (on la tire de l'observation de

(30) *Επὶ τὰς εἰκόνας ἰόντες θεῶνται...* (*Phèdre*, 250 B); *τιθέναι παρά, παρατιθέμενα, παραβάλλοντας* (*Politique*, 278 B).

(31) *Παραδείγματος γ' ἔστι τότε γένεσις, ὁπόταν...* (*Politique*, 278 C). On notera le rôle important de la répétition (souligné par μέχρηται en *Politique*, 278 B). Elle paraît être le facteur déclenchant de la brusque restructuration de l'expérience.

(32) Diogène Laërce, d'ailleurs, ne dit pas que Platon ait lui-même nommé ἐπαγωγή le procédé logique en question.

(33) *Οὐ μὴν μονοτρόπως, ἀλλὰ διχῆ, § 53 : ὁ τε κατ' ἐναντίωσιν, οὐ πρὸς τὸ δογματίζειν, ἀλλὰ πρὸς τὸ διελέγειν, § 54.*

(34) *Καὶ ὁ ἐκ τῆς ἀκολουθίας, § 53; εἰς τὴν τῶν ἑαυτῷ δοκούντων κατασκευήν, § 55.*

(35) En ce sens qu'elle donne la preuve particulière de propositions particulières.

contraires particuliers concrets, qu'on voit procéder l'un de l'autre : dormir procède d'être éveillé et inversement, ce qui est plus grand procède de ce qui est plus petit et inversement).

Si l'on en croit donc Diogène Laërce, Platon aurait fait de l'ἐπαγωγή un usage massif dans ses démonstrations (ἀποδείξεις)³⁶.

Mais le commentaire par Aulu-Gelle d'une plaidoirie de Caton nous apporte encore, sur l'ἐπαγωγή, quelques précisions nouvelles³⁷. Caton, défendant les Rhodiens, accusés d'avoir eu l'intention de faire la guerre aux Romains — mais sans l'avoir faite, néanmoins — aurait eu recours dans son argumentation au procédé en question.

La description de ce procédé par Aulu-Gelle le donne explicitement pour un argument peu honorable et trop osé, fourbe, fallacieux : «des habiletés de sophiste grec». L'argument de Caton est qu'on ne juge pas les gens sur des intentions et, dit Aulu-Gelle, il aurait «amené» (*induxisse*) cet argument par ce que les dialecticiens appellent ἐπαγωγή, chose insidieuse, captieuse et sophistique, moins faite pour établir la vérité que pour tromper les auditeurs.

Ainsi, Caton s'est efforcé, par des «exemples trompeurs», (*exemplis decipienlibus*) d'arriver à une conclusion (*conligere*), et d'établir (*confirmare*) sa thèse. Son argumentation a été la suivante. S'adressant à titre individuel aux assistants, Caton demande à chacun de s'interroger : chacun de vous, en ce qui le concerne, accepterait-il d'être puni pour ce qu'il a voulu faire de mal, sans le réaliser? Personne, en fait, ne l'accepterait. Moi, Caton, en tout cas, je m'y refuserais. (Notons qu'ici, le cas particulier, c'est chaque personne présente et à laquelle l'orateur s'adresse en particulier : «toi, et toi, et toi, accepteriez-vous? ... Moi, pas».)

Ensuite, Caton imagine un tarif des peines qu'on pourrait encourir pour avoir voulu posséder plus, par exemple (ici le cas particulier touche le contenu particulier du désir choisi comme exemple par Caton : s'enrichir) : on peut être puni pour être passé aux actes et être allé contre la loi pour s'enrichir, mais pas pour avoir simplement désiré s'accroître. Notons que si le procédé offre la possibilité d'un usage sophistique, c'est sans doute ici : dans le choix, par l'orateur, des cas particuliers qu'il va mettre en avant (comme : vouloir s'accroître) auxquels il finira par substituer, comme leur étant équivalent, le cas particulier qui intéresse proprement sa plaidoirie (vouloir faire la guerre).

(36) Voir notre article (issu d'un exposé présenté, en 1987, au séminaire du professeur P. Aubenque, dans le cadre du Centre de Recherches sur la Pensée Antique) : «Note sur l'Épagogé dans le *Sophiste*. A propos de Diogène Laërce III 53-55», à paraître dans l'ouvrage collectif *Études sur le Sophiste de Platon*, sous la direction de P. Aubenque, Naples : Bibliopolis.

(37) VI iii 34-47. Le terme ἐπαγωγή figure, en grec, aux paragraphes 35 et 44.

Après quoi, Caton a recours à l'argument par les contraires : on ne récompense pas quelqu'un sur ses intentions ; alors il n'y a pas de raison, non plus, de le punir sur ses intentions.

D'où il passe au point de vue général, qui sert de première conclusion, qu'il ne faut pas punir les gens sur leurs intentions non réalisées.

Or, cette conclusion s'applique, en la circonstance particulière, aux Rhodiens. D'où la conclusion définitive qu'il n'y a pas lieu de les punir.

Voici, maintenant, aussi éclairante, la critique par Tiron de cette plaidoirie : les trois arguments de Caton n'ont pas entre eux de commune mesure (*quin paria et consimilia non sint*). « Vouloir plus », s'agissant de cinq cents arpents est très différent, en effet, de vouloir faire une guerre injuste et impie ; il ne faut pas confondre ce qui est prohibé, illégal avec ce qui est injuste et impie. Et le cas de la récompense est, aussi, différent de celui de la punition. En effet, attendre qu'un crime ait été commis pour le punir, c'est folie pure : il faut prévenir le crime au lieu d'attendre que l'irréparable soit accompli.

Son reproche général est donc que les occurrences prétendument particulières n'ont pas été, en fait, suffisamment particularisées. Caton a procédé par amalgames successifs (entre « vouloir plus » et « vouloir la guerre », entre « illégal » et « immoral », entre le principe de la récompense et le principe de la punition).

Nous pouvons dès lors déterminer *a contrario*, sur ce témoignage, un critère au moins de ce que serait une *ἐπαγωγή* non sophistique : il faudrait, en tout cas, que les exemples (les cas particuliers) soient « *paria et consimilia* », tirés « de choses égales et semblables » (§ 40), c'est-à-dire de même nature, et qu'on puisse réellement les comparer ; il ne faut pas qu'il y ait « *disparilitas conlationis* », « inégalité de la comparaison » (§ 47). Il ne faut pas traiter comme homogène le disparate. L'usage sophistique consiste à confondre les choses, à les assimiler (ou à les distinguer) anarchiquement, sans respect de leurs véritables points communs et de leurs différences essentielles. Cela, parce que le sophiste se garde de poser, au départ, le critère de ce qui sera dit « même » ou « autre » et que les ressemblances et dissemblances sont de toutes sortes : profondes ou superficielles. Il suffit, alors, de substituer du superficiel à du profond et de faire comme si la ressemblance était transitive pour aboutir à l'assertion de n'importe quelle thèse avec l'apparence de la rigueur³⁸.

(38) Bien qu'il soit possible de rendre sophistique n'importe quelle forme de raisonnement, on comprend que le procédé que nous étudions ait pu être jugé spécialement susceptible d'un usage captieux en raison du rôle qu'y tient l'appréciation du « semblable ». Quand cette notion n'est pas strictement définie et qu'on l'abandonne au jugement de chacun, elle donne lieu à l'expression de la subjectivité la plus totale ; de plus, les difficultés rencontrées par les premières tentatives taxinomiques en biologie ont suffisamment montré qu'un critère apparemment évident (comme la taille, par exemple, ou le contour général)

Notons qu'un emploi péjoratif du terme semble se profiler déjà dans un texte d'Aristote, où il est question, justement, de Platon qui, dans l'*Hippias*, aurait fait une argumentation captieuse fondée sur le procédé d'*ἐπαγωγή*³⁹. Or, ce que fait Platon dans le passage incriminé, c'est, si l'on se place dans la perspective d'Aristote, une erreur de genre : Platon place dans le même genre, ou plutôt dans le même concept général (celui d'un être informé et conscient) l'homme véridique et le menteur, comme s'ils en constituaient les différences : mais les différences réelles seraient, en l'occurrence, « capable de dire vrai » et « capable de mentir ». Platon confond indûment « menteur » et « capable de mentir ». Cette assimilation est illégitime, parce qu'en passant de « capable de mentir » à « menteur » (au sens de « qui aime et choisit le faux pour l'amour du faux »), il se trouve qu'on sort du concept sus-mentionné.

Essayons, maintenant, avant de poursuivre, de récapituler les notions et les thèmes qui réapparaissent chez tous les auteurs, dans tous les passages où il est question de l'*ἐπαγωγή*.

Le procédé est toujours lié à l'analyse de cas particuliers, concrets. La perception, l'évidence sensible, y jouent un rôle de premier plan, par tout un aspect l'*ἐπαγωγή* se fonde sur l'analyse d'un *πάθος*. Il fait progresser le raisonnement à travers le sensible, les images sensibles et les perceptions sensibles. Liée à l'importance du cas particulier dans ce type de raisonnement, on notera l'importance de la notion d'exemple (*παράδειγμα*), qui apparaît comme capitale. Notons aussi le recours exigé à l'expérience individuelle, la nécessaire référence à un donné (inné ou déjà acquis) qui sert de point d'appui pour juger, par comparaison des cas particuliers nouveaux.

Ce sont des traits qui rendent le procédé, simultanément, apte à conduire un apprentissage et fragile devant la sophistique : par sa nature même, il se prête à la casuistique, et s'il n'est pas strictement réglé (comme dans le cas de l'enseignement), il fait à la sensibilité (à la réceptivité) de l'auditeur et, de façon concomitante, à l'autorité de l'orateur (du « conducteur », de celui qui « mène vers ») une place trop grande. C'est un procédé fondamentalement pédagogique (comme le souligne encore le rôle qu'y jouent la répétition, et le moment-clé de la restructuration, avec les déviations inévitables que cela implique du côté de l'art oratoire).

Maintenant, pour faire sans sophisme un raisonnement par *ἐπαγωγή*, il faut appliquer le procédé à des choses apparentées (qu'on pense, chez

peut être un critère de ressemblance très superficiel et qui ne fait que masquer les traits de ressemblance profonds.

(39) *Métaphysique*, Δ, 29, 1025a6-13 : τοῦτο δὲ ψεῦδος λαμβάνει διὰ τῆς ἐπαγωγῆς (lignes 9-10). Le passage de Platon auquel il est fait allusion est celui de l'*Hippias Mineur*, 365-369.

Platon, à l'exemple des lettres). La notion «τὸ ὁμοῖον» est capitale, et il est impératif de s'assurer de l'homogénéité des cas⁴⁰. Cela éclaire d'ailleurs, par contraste, l'usage également réfutatif du procédé : la réfutation opère par rejet du disparate.

Il faut mentionner encore, dans la constellation de notions qui gravitent autour de l'ἐπαγωγή, celle qui s'exprime par le verbe et le substantif correspondant : ἐπιφέρειν, ἐπιφορά. Chez les Stoïciens, ces termes signifient «conclure», «conclusion», mais chez Platon, ils ont le sens «appliquer», «application». C'est une partie, à notre avis, non négligeable de l'ἐπαγωγή, et qui signifierait à la fois, pour les cas particuliers, qu'ils viennent s'appliquer sur un cas général (qu'ils y entrent, qu'ils sont comme absorbé par lui), et que l'universel s'applique à des occurrences particulières (théorème). L'idée d'application intervient encore d'une autre façon : l'application d'un nom sur une chose sert de mise à l'épreuve, de *test*⁴¹. Par ce nouveau biais encore, on voit en quoi l'ἐπαγωγή peut aussi bien servir la démonstration que la réfutation : l'application sert à montrer si l'objet particulier considéré est ou non un ὁμοῖον de l'universel qui sert de pierre d'épreuve ; s'il n'est pas un ὁμοῖον, l'ἐπαγωγή devient une réfutation ; s'il en est un, elle devient une démonstration.

Munis de l'indication de ces caractères à la fois épars et dotés de cohérence, tentons de revenir à la perspective aristotélicienne.

Une chose particulière nous frappe dans les document que nous avons parcourus : dans les textes post-aristotéliens (comme dans la conception moderne de l'induction), il semble aller de soi que l'universel auquel donne accès l'ἐπαγωγή est une *proposition* universelle, et c'est en le présupposant qu'on traduit les textes d'Aristote, en rendant, par exemple, la phrase ἐπαγωγή ἡ ἀπὸ τῶν καθ' ἕκαστον ἐπὶ τὰ καθόλου ἔφοδος (105a13-14) par «le procédé qui consiste à partir des cas individuels pour accéder aux énoncés universels». Or ce caractère propositionnel est loin d'être évident chez Aristote, et même il nous semble que l'évidence va juste en sens contraire. C'est en tout cas ce que nous allons tenter de montrer.

Il y a dans la *Métaphysique*, en M, 4, 1078b27-31, un texte des plus éloquentes à cet égard. Aristote affirme là qu'il serait juste de reconnaître à Socrate le mérite de deux découvertes : le raisonnement «épagogique» ainsi que le geste de définir universellement.

Or ce témoignage jette une lumière inattendue sur notre problème : mis à part le fait que l'intention pédagogique du procédé devient d'une

(40) Sur ὁμοῖος, K. v. Fritz [2] p. 202, mentionne l'article «Xénophane» dans PAULY-WISSOWA *Realencyclopädie* 1541 sqq (notamment, 1552sq.).

(41) Cf. le *Cralyle* (*passim*) et le *Sophiste* 237 C : «ce nom de non-être, où l'appliquer, quel est son point d'application?».

évidence lumineuse, nous comprenons que Socrate, quant à lui, n'a pas inventé l'ἐπαγωγή pour fonder la validité de propositions universelles, mais pour arriver à la définition générale d'une notion : l'ἐπαγωγή socratique est le passage des individus à la détermination d'un concept⁴².

L'hypothèse est alors permise qu'il en aille de même chez Aristote également.

On notera, à l'appui de cette hypothèse, que tous les passages de la *Métaphysique*, en l'occurrence, où figure le terme ἐπαγωγή, et qui sont impénétrables tant qu'on veut les comprendre comme expliquant un passage d'énoncés particuliers à un énoncé général⁴³, s'éclairent immédiatement dès qu'on les pense en termes de notion générale ou de genre, et d'inclusion ou exclusion par rapport à ce support (qui peut être un concept, un genre, un schéma général, voire une règle, mais pas — en tout cas — l'énoncé général d'une proposition vraie).

C'est un nouveau biais encore par lequel nous comprenons pourquoi le procédé peut aussi bien servir, comme le rapporte Diogène Laërce, à la vérification positive qu'à la réfutation, suivant que «l'individu» considéré (le cas particulier, l'élément particulier, etc.) entre ou non dans un ensemble donné. Le critère pour en juger étant le couple du même et de l'autre (eu égard au genre).

(42) Nous avons un autre témoignage de l'origine socratique du procédé dans les exemples qu'en donne ΧΕΝΟΡΗΘΝ dans les *Mémorables* (voir, notamment, IV, 6, 13-15). Aristote lui-même donne d'autres précisions sur le procédé socratique et, en particulier, sur son application exclusive au domaine des notions morales en *Métaphysique* A, 6, 987b1-4, ainsi que sur le fait que, tout en cherchant l'universel dans ses définitions, Socrate a su ne pas séparer l'universel de l'individu, *op. cit.*, M, 9, 1086b2-13.

(43) Il est évident que, si ἐπαγωγή signifie «induction», les formules διὰ τῆς ἐπαγωγῆς (*Métaphysique* Δ, 29, 1025a10; I, 4, 1055b17; K, 11, 1067b14), τῇ ἐπαγωγῇ (Θ, 6, 1048a35-36) et ἐκ τῆς ἐπαγωγῆς (I, 3, 1054b33; 4, 1055a6; 8, 1058a9) surgissent de la plus étrange façon dans des passages où — mise à part l'indication apportée par la présence du mot ἐπαγωγή — on ne voit pas en quoi ni pourquoi il serait question d'induction. Il arrive même aux éditeurs d'hésiter sur l'emplacement effectif de l'ἐπαγωγή que l'auteur annonce. Le cas de I, 8, 1058a9 est frappant à cet égard : la mention de l'ἐπαγωγῇ conçue comme *induction* y apparaît si inattendue que W. D. Ross met la phrase δὴλον δὲ καὶ ἐκ τῆς ἐπαγωγῆς entre parenthèses, comme s'il s'agissait d'une simple remarque incidente et non point de l'annonce du raisonnement qui suit, raisonnement qu'il rattache, par-delà la parenthèse, aux lignes précédentes (cf. Ross, *Aristotle's Metaphysics*, T. I, *ad. loc.* et T. II, p. 301). Voir aussi J. TRICOT, *Aristote. La Métaphysique*, T. II, *ad. loc.*, p. 569, n. 2. Tous ces textes deviennent clairs dès qu'on prend conscience que le traitement par ἐπαγωγή consiste à montrer ou à dénier l'appartenance d'une notion à un genre. On notera que le schéma de ces passages est toujours le même : Aristote indique d'abord comment on peut *démontrer* quelque chose d'une notion donnée, après quoi, il ajoute «on peut aussi le montrer par ἐπαγωγή». Que fait-il alors ? En s'appuyant sur le genre, sur les contraires (dont le genre est le support) et sur les contradictoires (par lesquels on sort du genre), et en faisant intervenir les distinctions d'essentiel et accidentel, ainsi que la notion de propre, il se livre à une sorte de calcul qui aboutit à un classement des choses (et, plus précisément, de la chose particulière soumise à examen) par rapport au genre considéré.

Nous en arrivons, à ce stade de notre recherche, à la conclusion que l'ἐπαγωγή est, pour ainsi dire, la route «au» genre, au double sens de : la voie qui mène au genre ou la marche «sur» le genre (en direction du genre), mais aussi la méthode qui passe, pour expliquer ou enseigner le comportement d'une notion, par l'intuition — non pas au sens de pressentiment, mais de claire vision intellectuelle — du genre, et plus précisément du principe qui le commande (le point de ressemblance qui définit l'appartenance au genre); et des limites hors desquelles on sort du genre (l'extension du genre est donnée par l'indication de sa différence la plus grande : l'opposition des contraires).

Le premier sens semble correspondre à l'usage proprement socratique du terme. Le «passage» qui caractérise l'ἐπαγωγή signifie la «menée», par la maïeutique, à l'universel, c'est-à-dire à la définition d'un concept (avec ce que le terme de «mener» implique de pédagogique). Il s'agit, sous la direction d'un «orienteur» qui conduit le dialogue, d'une *introduction* des participants à la *généralité* en partant de cas particuliers concrets. Le procédé consiste, en effet, à prendre appui sur des occurrences particulières : c'est à partir, par exemple, d'une pluralité de choses particulières diverses, mais toutes dites «bonnes» qu'on accède à la notion de «bon en général» ou de «Bien». Le recours à la comparaison et à la ressemblance est donc capital, car il faut percevoir ce qu'ont de commun ces cas particuliers du «bon» : le bon stratège, la bonne cuiller de bois, le bon cheval, l'homme bon, et tout le reste de ce qu'on dit tel.

Le second sens (méthode, non de démonstration, mais, si l'on peut dire, de «monstration» ou de mise en évidence par application du genre) apparaît plutôt lié à l'usage aristotélicien. Toutefois, l'évolution en ce sens de l'ἐπαγωγή pourrait avoir commencé déjà chez Platon, cet emploi paraissant résulter directement de celui de Socrate : une fois le genre trouvé par l'ἐπαγωγή socratique, il devient possible de montrer (et même, selon le témoignage de Diogène Laërce sur Platon, de démontrer) par «application du genre», c'est-à-dire en montrant que la notion étudiée appartient à tel genre donné (ἐπαγωγή positive) ou ne lui appartient pas (ἐπαγωγή de réfutation). C'est la notion de similitude que semble avoir principalement approfondie Aristote. Car le genre en provient directement : il repose sur le trait fondamental de ressemblance qui fonde une *lignée* — et tout en distinguant les sens (*Métaphysique* Δ, 28 : γένος), Aristote sait fort bien que son «genre» est une lignée d'êtres.

L'usage aristotélicien de l'ἐπαγωγή se fonde, en effet, sur l'idée centrale qu'il y a des choses qui, par ressemblance, «vont ensemble» (l'alphabet ou les nombres en sont l'image la plus frappante), et il importe peu que leur lignée soit finie ou infinie : l'important est qu'elles se comportent de la même manière, qu'elles obéissent à la même règle. Quand Aristote dit qu'être un nombre a pour point de départ être l'unité (*Métaphysique*, Δ, 6, 1016b17-18), il applique la conception du nombre

développé en *Métaphysique*, I, M et N ; et dont il ressort qu'on obtient un premier nombre en prenant pour point de départ l'unité et en ajoutant un, et le reste des nombres en recommençant. Voilà la règle, voilà ce qui définit le genre «nombre».

Interprétons cela en termes d'ἐπαγωγή. Le cadre le plus propice à l'utilisation de cette dernière est, nous l'avons vu, celui de l'apprentissage. Supposons qu'il s'agisse d'apprendre à compter ou d'apprendre ce qu'est un nombre. La question est de faire comprendre concrètement «comment ça marche» en faisant apparaître sur des nombres concrets que, d'un nombre à l'autre, il y a quelque chose qui est, à chaque fois, la même chose et se répète semblablement (le genre est, précisément, ce que deux choses différentes ont en commun). Voyons alors comment se distribuent les divers aspects de l'ἐπαγωγή apparus lors de nos précédentes analyses.

Les cas *particuliers* sont, bien entendu, les nombres sur lesquels on montre la règle «ajouter un». Et peu importe, à notre avis, la quantité de ces cas particuliers : elle ne dépend que de la rapidité de l'apprenti à repérer une constance sous couvert d'une diversité. En l'occurrence, la diversité est celle des différents nombres et la constance est dans la règle de leur succession. Et peu importe, également, que la suite des nombres soit sans fin (le procédé n'a rien à voir avec l'induction complète), quel que soit le nombre particulier considéré, on sait — une fois qu'on a vu le comportement du nombre, qu'on a assimilé ce qu'est un nombre — qu'il sera constitué de celui qui le précède augmenté d'une unité. On peut appeler cela une *généralisation*, mais à condition de l'entendre littéralement, c'est-à-dire comme le passage au *genre*, comme l'acquisition du *genre* et la capacité, dérivant de cette acquisition, d'en faire usage — ce qu'on fait en l'*appliquant* à de nouveaux cas particuliers, c'est-à-dire, en l'occurrence, en appliquant à chaque nouveau nombre la même règle. Cependant, s'il y avait proprement généralisation, c'est-à-dire passage à des *propositions* vraies universellement, Aristote n'opposerait sans doute pas l'ἐπαγωγή au raisonnement déductif (λόγος), au syllogisme (συλλογισμός), à la démonstration (ἀπόδειξις). La généralité de l'ἐπαγωγή est celle de l'application «universelle» (c'est-à-dire l'application à chaque nouvel élément du genre) de la règle qui définit le genre. En un sens, on reste toujours sur le plan des cas particuliers : on ne fait que passer d'un cas particulier à un autre. On ne traite effectivement que du particulier. La notion d'universalité, ou de totalité, n'intervient pas, en effet, dans le procédé en question, comme telle, c'est-à-dire à titre propre et distinct, autrement dit séparément des individus : mais, à travers la similitude de ces individus, elle n'apparaît — indissolublement liée à eux — que sous la forme de leur lignée, de leur genre (à savoir, dans notre exemple, le nombre). C'est que l'universalité, au sens aristotélicien du terme, n'est pas d'ordre essentiellement quantitatif (rien n'indique que le nombre de

cas doit impérativement entrer en jeu dans une ἐπαγωγή; et, même s'il est vrai qu'un prédicat *universel* est celui qu'on peut dire «de tout», il suffit de substituer la notion de nécessité à celle de ce «tout», pour constater, devant l'indifférence d'une telle substitution chez Aristote, que la totalité en question n'a pas de signification qui soit fondamentalement numérique⁴⁴. Dans l'ἐπαγωγή d'Aristote, on peut toujours mettre le nombre de cas entre parenthèses. Il n'est pas capital. On peut faire une ἐπαγωγή ayant valeur «universelle» sur deux cas.

Là, c'est-à-dire dans le fait que, pour Aristote, un universel n'est pas un individu et n'est donc pas «séparable», se trouve, nous a-t-il semblé, le point essentiel : Aristote a vu dans l'ἐπαγωγή, à la stricte condition qu'on la pratique dans une perspective socratique, une méthode qui, s'agissant de l'universel, a l'incomparable mérite — par contraste avec l'usage déviant de Platon qui conçoit l'abstraction comme une séparation — de ne jamais disjoindre le genre et l'individu. Et c'est pourquoi Aristote a voulu, par-delà Platon, tenir directement de Socrate sa propre ἐπαγωγή⁴⁵.

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(44) L'équivalence, chez Aristote, entre nécessité et quantificateur universel a été notée par J. LUKASIEWICZ, dans son ouvrage *Aristotle's Syllogistic, from the standpoint of modern formal logic*, Oxford, 1957² (1951) § 5 (p. 30-31 de la traduction française, Paris : A. Colin, 1972).

(45) Le passage, déjà cité plus haut, de la *Métaphysique* M, 9, 1086b2sq est suffisamment explicite sur ce point, qui dit en substance : Socrate, en introduisant les définitions, a eu le mérite de ne pas séparer l'universel de l'individu, et il a eu raison de ne pas les séparer. A juger sur pièces, on voit que, d'un côté, sans l'universel, la science n'est pas possible : mais, d'un autre côté, si l'on sépare cet universel, on tombe dans toutes les difficultés liées à la théorie des Idées.

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NATURE AND CRAFT IN ARISTOTELIAN TELEOLOGY

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PART A: INTRODUCTION

(1) It used quite commonly to be argued against Aristotelian teleology that this type of explanation founders for lack of a suitable psychological basis in most of the phenomena for which it was invoked. The objection was that it does not make sense to attempt to explain X as happening or existing in order that Y should happen or exist unless one assumes that the production of X and Y is guided by thoughts, desires or conscious purposes relating Y as end to X as means. Yet Aristotle himself makes it clear that the domain in which, as he believes, teleological explanation is not merely illuminating but mandatory if we are to have any adequate explanations at all, extends well beyond the domain of entities to which beliefs, desires and conscious purposes can be reasonably ascribed. Nor, on the other hand, does Aristotle protect himself against the objection by introducing a supernatural being who produces or shapes phenomena in accordance with divine intent. Thus if the application of teleology does depend on the presence of psychological factors such as those mentioned, it is a dependence which Aristotle fails outright to notice. Alternatively, there is no such failure because the claimed dependence does not hold.

(2) This poses the question: Is a non-psychological teleology as intelligible as Aristotle evidently takes it to be? We may be tempted to turn a deaf ear to this question if it seems to us that in other respects Aristotelian teleological explanations are effective or at any rate more effective than alternatives given the state of knowledge. But embarrassing though it may be for Aristotelians, the question is *prima facie* a pressing one precisely for them. What makes it so is Aristotle's

characteristic appeal to the notion of craft (*techne*) as analogue for his conception of nature (*physis*). Nature, in this context, is not Nature in general, or the cosmos, but the specific essential nature of an individual substance, the inner principle of its behaviour and organisation. It is nature in this sense that Aristotle likens to craft — that is, to one or another specific craft; for the crafts are principles of activity vested in particular individuals who live, move and have their being within the physical world. Craft in its active exercise is evidently end-directed, and to Aristotle the same is true of nature, although less evidently so. Thus it is craft that provides the model for nature, not the reverse. That the comparison goes in this direction might seem too obvious for mention, except that just at this point we confront what seems the most vulnerable spot in Aristotle's position. If one were to establish independently the idea of the nature of a thing as end-directed, and were then to use this conception of nature to explain what should be meant by the end-directedness of craft, one might well achieve the interesting result of having developed a notion of craft (that is, the exercise of craft) in which psychological concepts play no essential part. For generally speaking, natures are not psychological, and in this backwards analogy it is craft that is likened to nature. I shall return later to this possible way of conceiving of craft. Meanwhile, in Aristotle's actual account craft is the model, and the nature of a thing the explanandum: which is not surprising, since we have more of a pre-reflective grasp of the idea of craft than we do of the idea of a thing's nature. But now the vulnerable side: isn't it also part of that familiar pre-reflective notion of craft that craftsmen are human beings operating from beliefs, desires and conscious purposes — and that without all this craft would not be possible? But if that is so, are we not right to mistrust Aristotle's confidence that nature can be coherently treated as teleological like craft, even though the operations of nature, unlike the operations of craft, mostly do not depend on psychological attitudes?

(3) There are a number of problems here. I shall indicate two, with the aim of focusing on the second. First there is the traditional objection to natural teleology: "How can a state of affairs that is at best future and at worst never occurs at all (since the end may not be realised) exert an influence in the present? Only something now can cause something now: for example, a present desire causes a movement. But nothing future can cause a present movement otherwise than as the object of something present; in which case what really causes the movement is the present item, of which the future one is only the object. So take away such present items as desire, will and conscious design, and you take away the basis for applying any explanation that refers to what is not yet." It is sometimes commented that this argument crudely mistakes final for efficient causes: efficient

causes cannot operate unless as already existent, but the whole point about final causes is that they can (not that this "can" attributes some extraordinary capacity); thus surprise here simply betrays failure to grasp the idea of final causality. But this response is itself inadequate insofar as it suggests not only that a final cause is not an efficient cause, but that a final cause can function on its own without an efficient cause. No doubt that would make sense if one could indeed intelligibly think of a final cause as a surrogate efficient, something planted there in the future and backhandedly stirring things up in the present. That is what the objection rightly finds to be nonsensical. But in Aristotle, final and efficient causality are complementary: the end is an end of or for an agent, and the agent as such is bent on an end. And this complementarity is general, applying where will or desire is present, but also where they are not. Thus it is not as if the absence in a given case of empirical psychological factors forces us into the following choice: *either* (a) there is only a final cause functioning in a vacuum (which is absurd), *or* (b) final causality does not obtain at all, *or* (c) final causality does obtain, but only through the medium of a specially postulated empirically unidentifiable desire or the like. These options are not exhaustive unless one assumes that it is only in virtue of a desire or conscious purpose that an agent can be an end-oriented efficient cause of some objective which in turn functions as final cause of that active efficiency. In other words, the assumption is that intentionality — or more precisely, end-wardness — must be mental or grounded in the mental, in the sense of requiring a mental representation of the end.

(4) However, Aristotelian teleology clearly dispenses with this assumption. That brings me to the second problem: Does non-psychological end-directedness make sense? This paper is not an attempt at a general answer to this question; it has the narrower purpose of examining for coherence one example of the view at issue — a surely paradigm example, though, since Aristotle is the greatest historical exponent of this way of thinking. A verdict on coherence requires consideration of the relation between Aristotle's doctrine of natural teleology and his use of the craft analogy. That is my concern in what follows. I shall mainly consider two questions: (i) Does the doctrine depend on the craft analogy? (ii) Does the craft analogy import undesirable psychological elements into the doctrine? If the answer to the first question is No, then it does not matter if the answer to the second is Yes. I shall, however, argue that the answer to the first is Yes, and to the second No (respectively in Parts B and C). I shall then (Part D) consider further problems arising from the craft analogy.

PART B: IS THE CRAFT ANALOGY NECESSARY?

(5) An excellent starting point is already at hand in John Cooper's paper "Aristotle on natural teleology".¹ By a very clear and thorough argument Cooper shows a way in which we may understand Aristotelian teleology without tacit appeal to psychological factors. The argument rests on Aristotle's view that the species are eternal. Cooper presents it as a fundamental fact of the Aristotelian universe that the organic forms realised at any given time should never not be realised through individuals of the relevant kinds. This fact, on Cooper's account, is what we would probably call an ultimate law of nature. That it obtains is not something that can be explained. In particular, it cannot be explained as due to the movements and properties of the inorganic materials to be found in the universe. Cooper stresses, as others have done,² that given the evidence available to Aristotle it would be entirely reasonable to conclude that the behaviour of inorganic materials could not account for the formation, preservation and propagation *in saecula saeculorum* according to kind, of those highly organised self-maintaining systems we call living creatures. On the other hand, to put all this down to sheer accident is simply absurd. Moreover, even if (as is assumed not to be the case) organic phenomena could be explained materialistically in terms of the coming together of inorganic elements each pursuing its own natural course, the biological *viability* of the resultant wholes would still be an accidental by-product of the workings of those simpler natures. For what would be explained would only be the individual positionings of the elements which, positioned as each is, happen to compose viable organic unities. The unities as such would not be explained. And that, for Aristotle, is no less absurd, given that these supposed 'by-products' are, in his view, *eternally* reinstantiated. But the only alternative to treating the eternal reinstantiation as a brute fact unencompassed by any explanation is to treat it, itself, as a basic principle of explanation. So instead of thinking of it as belonging on the level of what it makes sense to try to explain in terms of matter — or to bemoan as inexplicable if such explanation fails to fit — we should rather think of the behaviour of

(1) In *Language and Logos, Studies in Ancient Greek Philosophy*, edd. Malcolm Schofield and Martha Nussbaum, C.U.P. 1982.

(2) E.g. Allan Gotthelf, "Aristotle's Conception of Final Causality", *Review of Metaphysics* 1976; Sarah Waterlow, *Nature, Change, and Agency in Aristotle's Physics* (O.U.P. 1982), ch. 2.

matter as explicable in terms of *it*. Thus we move to saying that it is *because* there are, and eternally are to be, such organised living systems that the materials which form their bodies, their food and their environment, arrange themselves in ways that make it true that those systems are and are to be. In other words: since they are and are to be, and since this cannot happen unless the materials behave in certain ways, the materials must behave in those ways — *in order that* the forms be realised.

(6) This analysis is broadly in the spirit of the texts,³ and, as Cooper points out,⁴ it has the merit of showing how a rational teleology need owe nothing to psychological assumptions. Granted that under certain intellectual conditions it is only reasonable to apply teleological explanation to organic phenomena, then *not* to apply it, given such conditions, would be (one might argue) so unacceptable that even if the psychological assumptions were legitimately available their addition could hardly strengthen the already adequate case for teleology. But now how does Aristotle's craft analogy fare in the light of all this? On Cooper's account it seems inessential. Thus Cooper writes: "...one must reject the suggestion that is sometimes made that this analogy is central and fundamental to Aristotelian teleology."⁵ The dismissal is surprising. For surely it is Aristotle's own texts that cumulatively make the suggestion through innumerable emphatic occurrences of the analogy. Cooper correctly points out that at least one of Aristotle's arguments for natural teleology does not rely on the analogy.⁶ However, it does not follow that Aristotle's full view can be properly represented without it. It is possible, of course, that he gives the analogy more prominence than it deserves for the amount of good it does; but why should one suspect this? One motive, if not reason, that might weigh with an apologist for Aristotelian teleology would be the thought that the craft analogy carries unwanted psychological implications.

(7) Unwanted implications or not, I shall now argue that the craft analogy, though possibly dispensable to some versions of natural teleology, makes an essential contribution to the Aristotelian version. This contribution is, however, of metaphysical rather than scientific significance. Hence it may well be overlooked in the context of the debate on the scientific merits of teleological as opposed, say, to mechanistic explanation. Aristotelian teleology, as clarified by Cooper, rests on two presumptions whose reasonableness depends on empirical

(3) But for an important qualification see paras. 8-9 and note 7.

(4) Cooper, *op. cit.*, p. 221.

(5) Cooper, p. 198, fn. 2.

(6) *Phys.* 198b32-199a8.

evidence together with certain extrapolations from this. One is that the living forms are never not instantiated; the other that this fact cannot be explained in terms of the material components. There is also the consideration that in biology, teleological explanations are found to work well; for example, they generate predictions, and the predictions are often confirmed. Now the empirical facts (or presumed facts) that make teleology scientifically attractive do not in themselves dictate any underlying metaphysic. Indeed, there is no reason why the teleologising scientist, any more than his mechanising counterpart in some other age (or other field of phenomena), should embrace any particular metaphysics at all. To give a non-teleological example: the reactions of a compound at various temperatures are explained in terms of molecular theory. That explanation is consistent with distinct metaphysical positions regarding the ground of what are empirically identified as causal connections. Thus one may suppose a non-empirical bond or tie by which a molecular re-arrangement is directly 'powered' by a change in temperature; or one might take the sequent phenomena to be each 'powered' to occur in the sequence by the will of God alone. Or one might hold that nothing whatever is the case beyond the fact that, this time too, an event of the first type is followed by one of the second.

(8) Natural teleology is likewise open to a variety of metaphysical interpretations. For example, one might hold that it is inherent in the nature of something called "the Universe" that certain forms be always realised. On that view, the form-realising behaviour of materials has a single metaphysical ground, namely the nature of the Universe. If the realising of some form is to be considered a goal, then it is a goal for the Universe, an imperative incumbent upon the cosmos.⁷ It is not a goal for any of the circumscribed physical things whose behaviour and development is teleologically explained as being necessary for the realisation of the form. For if the goal is the Universe's goal, these physical things are *its* means and instruments; but means and instruments do not 'have' a goal in the sense in which what uses them has. To make the point we need not suppose the Universe to be a thinking being with conscious purposes, any more than we need suppose a transcendent God who intends that the forms be realised and consequently wills that matter falls into the necessary patterns. The

(7) Cooper's language frequently leans in this direction; e.g.: "...it is an inherent, non-derivative fact about the natural world that it consists in part of natural kinds and works to maintain them permanently in existence... it is a fundamental fact about the world... that it maintains for ever these good life forms..." (p. 213; my emphasis). But, strictly, Aristotle's metaphysical pluralism implies that there are as many 'fundamental facts' as there are distinct kinds of organic substance: for each kind the fact that *it* is always instantiated.

point is threefold: firstly, that the conditions under which it is appropriate to apply teleological explanation as analysed by Cooper may be satisfied even on the assumption that it belongs to *the* nature of the Universe that organic forms be always realised; secondly, that such an assumption is thoroughly unaristotelian; thirdly, that it fails to be Aristotelian not because the Universe is conceived as a conscious being (this is not necessary to the assumption), but because there is no place here for Aristotelian natural substances. According to the picture just sketched, the realisation of some given form is a goal served by but not grounded in the natures of whatever physical objects behave in the appropriate ways. Are we now even entitled to think of these as having *natures* at all, in Aristotle's sense? For what he means by a "nature" is not merely a set of dispositions to behave in certain ways, but the inner source of such behaviour.⁸ In particular, it is the source of the changes by which relatively undifferentiated matter develops into a given form. To speak of the physical thing as the source of its changes in this way is to say more than that it exhibits change that cannot be accounted for by physically external factors. That is an empirical matter, and is compatible with the metaphysical view that all changes are grounded in the nature of the Universe. The Universe thereby becomes the one substance, according to Aristotle's equation of *being a substance* with *being a source of change*.⁹ Ordinary physical objects, on this view, must be construed as modes of that substance, they being merely subjects of change and not metaphysically independent sources.

(9) The difference between this and the metaphysical teleology of Aristotle may be illustrated by reference to the difference between two ways of representing goals, one predicative, one propositional. It is common ground that (let us suppose) relatively undistinguished blobs of matter (e.g. frog spawn) change and develop in ways which one cannot begin to explain in terms solely of what is present — the shape, weight, viscosity, temperature, etc. — but which fall into place in the light of our knowledge that what each blob will eventually have become is a frog. Should we then say that the goal is *that there should be (or have become) a frog*; or is it rather *to be (or have become) one*? The former represents an end logically appropriate for the Universe as agent; the latter for an Aristotelian natural substance, which in this example is precisely that potential frog on the way to becoming what it is *its* goal to become, namely an actual one: which actuality, if achieved, is achieved not merely *for* it but *by* it. Now this is the conception that the craft analogy is surely intended to hammer home: the conception, namely, of

(8) *Phys.* 192b13-23.

(9) *Phys.* 192b33; cf. 193a9-10 and 20.

particular physical things as themselves metaphysical centres of the development towards form. For the craftsman too is a source of change operating as one of many within the order of nature. The difference is that his goal is not to have become a so and so, but to have made something into a so and so by the practice of his art. So far as natural objects are concerned, one might easily suppose them to be mere subjects of change, who knows what the source of it? But with craft, the functions of *source* and *subject* are clearly partitioned, since in general the development for which craft is responsible is located in an object external to the craftsman.³⁰ By taking craft as model for the specific natures of particular physical objects, Aristotle unambiguously declares their status as *metaphysical centres of activity*. Without the craft analogy we should still have teleological explanation, but not the Aristotelian concept of natural substances.

PART C: A NON-PROBLEM OF THE CRAFT ANALOGY

(10) It would be unfortunate if the craft analogy, necessary as I have argued it to be, should finally prove dependent on psychological assumptions alien to Aristotelian teleology. This is now the question. Let us start with the consideration that this analogy is a complex package containing very much more than the elements of belief and desire sometimes deemed necessary for teleology to make sense. If these are what has to be invoked to support the notions of goal-directed natural processes, why say more than that such processes are like the operations of a consciously purposeful agent? Why confine attention to craft, when so many of our deliberate ends and means owe nothing to special expertise? Why not take going to a neighbour's house in order to find out the latest news? Here are some reasons. (a) The world of craft is divided into craftsmen of *various kinds*, each *qua* craftsman seriously dedicated to his own speciality. So it is with the world of natural substances. For each individual there is the circumscribed end proper to its specific definable essence, and for each an equivalently circumscribed range of means. There are no amateurs here, or dilettanti. (b) The matchless professionalism of healthy natural substances is shown in the *regularity* of their behaviour. Craft, with its rules and repeatable applications, echoes this, even though a realistic view of human history must allow that crafts develop, discovering not only new methods but new horizons. (c) Nature makes *correct* moves, and so does craft. That is to say: while a craftsman may make mistakes, his claim

(10) *Phys.* 192b15-20; *Metaph.* 1070a7.

to the title, as Thrasy Machus pointed out in the *Republic*,¹¹ depends on knowledge, not on misjudgment. Those who think that teleological explanation needs psychological assumptions are concerned with beliefs (as well as with desires, intentions, conscious purposes). But to play the desired explanatory role, the beliefs need not be correct. It can hardly be that the image of the craftsman is invoked mainly in order to supply the element of belief. (d) The metaphysical *unity* of an Aristotelian nature is mirrored by the teleological unity of craft-cognition with craft-goal. By this I mean that the knowledge exercised in craft is normally developed precisely with a view to the craftsman's purpose. This is true not only of the necessary causal generalisations, but also of the particular observations required for applying these in an actual situation. The cognitive system exists and operates only as called upon for the end. Idealised, this concept approximates to the concept of an Aristotelian nature, where the end and the capacity to realise it are perfectly integrated. It is not as if the capacity, in any given case, could have been used to some other end, or is more than is needed for this. Contrast, in this respect, both nature and craft with what we may call "ordinary" human purposive action, where, as likely as not, the relevant desire or interest, and the relevant beliefs or cognitive states, were developed independently and come together by an external synthesis. (e) 'Ordinary' purposive actions are usually explained by saying that the agent desired so and so, or that he had a reason for pursuing so and so. Such statements do not as a rule appear in explanations of the activities of natural substances, since in general we do not think that these operations express desires or reflective concerns. But the same is true of the operations of craft, considered simply as such. There is a sense in which the craftsman as such is *too* practical to be animated by desire or reasoned concern for the end. To say of someone that he operates as a builder is already to have implied that he pursues the builder's typifying end (not merely that he exercises the special skills). The builder as such cannot want to build houses in any sense in which wanting to build houses could explain building by *the builder*. Nor is it his business, *qua* builder, to have reasons for building. The builder here is, of course, an abstraction, and it is only to this abstraction that these remarks apply. They do not suggest that a human individual might not engage in builder-activity for some reason, or because he wanted to do this work or have its product. A tree would have to be more than a tree if it were a tree *because* it desired to be a tree. This is not because trees are incapable of psychological attitudes such as desire, but because even the desires of such organisms, were they

(11) 340c-e.

to have them, would be expressions of their perfect — tree-form seeking tendency, hence not explanatory of it.

(11) Point (e) above is the direct claim that the craftsman as such cannot be said to have the psychological attitude of desire for the craftsman's goal. Some of the previous points should help to construct a similar case regarding other psychological attitudes. Aristotle says that craft does not deliberate.¹² He might have added that in paradigm cases the craftsman in action does not even have thoughts about whatever it is he does that constitutes his exercise of skill, except under two circumstances: one, where he is still learning, and the other, where he is demonstrating so as to teach the art. But in the first case he is less than a craftsman, and in the second case more. With regard to the ascription of belief, two features should cause us to hesitate. No doubt we are concerned with an idealised case of craft, but it is in terms of such that imperfect cases are to be understood. First, there are no mistakes; second, there is perfect fit between the cognitive system and the end to be achieved. But now where the question of error does not arise, is there need or room for the notion of belief (at any rate so far as this involves the idea of a true-or-false mental representation)? And where the cognitive material is wholly at the service of a given end, is there room for ascribing a factual (or proposition-asserting) attitude such as the word "belief" commonly implies? To answer Yes with confidence one would have to be sure that our distinction between belief and, say, desire (which distinction plays a significant part in determining the meaning of "belief") could still be drawn in the case mentioned. But would that be possible if the alleged belief had no life or history of its own independent of that one conative context?

(12) These remarks are only pointers, but pointers in a direction which for the present limited purpose is perhaps sufficiently clear. We have at any rate shifted the burden of proof to those who would deny what is here suggested: namely, that craft is non-psychological in precisely those respects in which craft is most suited to provide the model for nature.

PART D: FURTHER CONSIDERATIONS

(13) I have argued that Aristotle's craft-analogy for nature does not introduce the psychologism sometimes feared. But his use of the analogy is by no means all plain sailing. Here I shall examine some problematic ramifications. In the first place, the concept of craft is

(12) *Phys.* 199b26-8.

supported by presuppositions which on reflection might lead one to question the propriety of using it to further our understanding of nature. One such presupposition of course is that a natural order is already there, providing conditions for the growth and exercise of human skill. Even if craft is itself an expression of *human* nature, craft is a rationally organised attempt to control objects and forces already at work independently. Thus craft is a fitting analogy for the nature of a non-human natural substance only to the extent that we can conceive of such a substance as depending for its orderly development on natural qualities and relations of natural objects other than itself: which objects, in this context, are regarded as materials for the realisation of the natural form in question. Aristotle finds no trouble in understanding the world of nature in this way. Nor, I think, should he, so far as method is concerned. Someone might object that if non-human natures in general are to be conceived on the model of the craftsman, then the presupposition just mentioned will force us round in a circle when we come to analyse craft. But the objection is superficial: although we cannot make sense of craft without presupposing natures which craft has not touched, there is no incoherence in treating the latter as also craft-like in turn. For it is not in the same conceptual breath that we both oppose them and liken them to craft. Even if natures are craft-like, it is not on account of this resemblance that nature is a precondition for craft. The dependence here considered of craft upon what is not craft can be grasped without circularity as well by Aristotelians as by those philosophers who claim to find nothing craftsman-like in nature.

(14) But there is another presupposition which gives rise to doubts less easy to weigh. Just as craft depends on a world of non-human substances confronted as independently there, so craft assumes non-craft on the human side as well. Craftsmen must know what nature makes possible given the human will to guide and divert natural processes towards human objectives. But the objectives themselves ultimately rest on principles belonging to no special craft. The craftsman, whatever his kind, aims at some good; but to say this is to say more than that the craftsman aims at the end that defines his craft. For the end aimed at is not good because in that craft it is the end aimed at; rather, it is aimed at because it is of value as answering to some human need, passion or interest. No doubt if the carpenter were nothing but a carpenter, the good as conceived by him would be nothing other than the production of cabinet work; but the same would be true, *mulalis mulandis*, of the craftsman, if such there were, whose *métier* it was to blow curious arrangements of soap-bubbles. In fact, however, it is good that certain articles are produced, because these articles are regularly wanted for reasons having nothing to do with the craft of their production. This is by contrast with the hypothetical case in which the defining end of some conceivable craft *would* be good if its products *were*

of any importance. Now the real carpenter, an intelligent human being, operates as such: that is, with an eye to the needs that called forth the exercise of his craft in the first place. While expertise may be necessary to convert, say, the need for shelter and for various utensils into practicable objectives, one does not have to be an expert to appreciate the desirability of such products. This rests with the judgment of those who are not carpenters, or not merely carpenters. Aristotle, as everyone knows, takes such judgments to be grounded in a conception of human happiness of the good of man *qua* man. The lowly carpenter may not give this much thought in the sense of concerning himself with some all-round definition; but he responds to market forces, or ignores them at his peril, both with respect to what he makes, and to its timing and quantity. Thus it is only in a highly abstract sense that a given type of craftsman always produces the same. There are times when he produces nothing even though awake and physically capable, and so far as he does produce, the character of his objective is constantly subject to re-interpretation such as never occurs in the non-human world according to Aristotle's view.

(15) In short, the specific crafts are not autonomous but operate within limits set by what Aristotle calls "*phronesis*": wisdom about the whole of practical life. It is true that Aristotle sometimes follows Plato in a schematic division of labour: the carpenter is one entity and the being who dictates the when, where and how much of the carpenter's activity is another — the *politikos*, whose concern is for the good in all its aspects.¹³ But that is for the purpose of analysis only. The actual carpenter has to be something of a *politikos*: not necessarily a 'statesman' in some high sense, but a social being. His excellence in his particular trade depends in part on this, for who would employ a carpenter who understood nothing but carpentry? More to the point, such a notion is hardly intelligible. Craft is essentially practical, or (to speak more abstractly) a source of orderly change. That is the basis of the analogy with nature. But from craft alone nothing comes about. For even if *what* the craftsman does in making what he makes can be explained by the principles of his craft, *that* these principles operate at all, and when and to what degree, depends on ulterior values.¹⁴ This is by contrast with the nature of a natural substance, which is not merely an inner principle of change, but, as Aristotle says, an innate *impulse* (*hormē*)¹⁵ of change, so that the characteristic developments must occur in the absence of physical impediment. When, as in *Melaph. Z 7*,¹⁶ Aristotle compares the active

(13) *Eth. Nic.* 1094a26 ff., for instance.

(14) Cf. *ibid.* 1139a35-b3.

(15) *Phys.* 192b18-19.

(16) 1032a32-b1.

essence of a natural thing with "the form in the soul of the craftsman", he speaks as if the craft-form itself holds all that it needs in order to be functional. In effect, then, Aristotle here treats craft as conceptually isolable from those non-technical factors that set its objective. But this is to distort the notion of craft, if (as I argue) we cannot make sense of craft otherwise than as practical, and further cannot make sense of craft as actively practical without noting its dependence on something other than itself, namely general practical wisdom. This is not to say that this isolated notion of craft may not illustrate something of what Aristotle understands by "nature"; but it does mean that he cannot safely *model* nature on craft, since if we take one thing as model for another, we expect the latter's structure to exhibit all that is essential in the former. If the natures of things really paralleled human crafts, then (as has already been indicated) nature would not behave with the massive constancy that is its hallmark. And the parallel undermines that metaphysical pluralism which, as I suggested in the second section, the craftsman analogy helps to sustain. We now see that this help is afforded only by a notion of craft plucked out of the system of conceptual connections that give it life. For considered in the round, a craft is more like an organ than it is like an independent substantial principle. With an organ there must be a user who rationally co-ordinates the use of it with the use of others. The user of a craft is the social individual, who stands in this relation to many crafts, although his involvement with them takes different forms depending on which are practised by him and which by others. Once this line of thought is applied to nature, it becomes tempting to postulate a single universal natural principle directed towards some one end to which each part of the physical world must be understood as subordinate. In a few passages Aristotle seems to move in this direction. We need not wonder, considering that the craft-analogy, unguarded, is bound to lead this way.

(16) I have attended so far to one point at which the concept of craft must be circumscribed if it is to play its expected part in the analogy: this was at the interface of craft with practical wisdom. But there are further necessary restrictions, of which some have to do with the specialist aspect of craft. Crafts are learnt, and they are passed on by teaching: in which respect the species of craft differ essentially from the species of nature. For it is surely of the essence of craft to be transmitted by cultural as distinct from genetic inheritance. Here, perhaps, is the ground for that special dimension of rationality that makes craft so intensely significant to the Greek philosophers. This is the dimension in which functioning in accordance with rational principles is integrated with the reflective knowledge of those principles and the power to communicate what they are. Now if, as Aristotle

believes, non-human natures act unawares for the sake of ends, and regularly achieve those ends by natural strategies of astounding ingenuity, then what purpose is served by reflection? It cannot be in general that reflection is necessary or even useful for accomplishing ends, since performance is faultless in countless cases where reflection never enters. On the other hand, it is natural for human beings to act reflectively, and nature does nothing in vain. We must therefore suppose that human beings are distinguished by having ends that can only be achieved through reflection, and through the giving and taking of reasons. One such end that concerns us here is the transmission of forms of activity that are saved from dying with the individual only by being taught. *Reflective* rationality, according to this approach, is the means by which human nature compensates for its own failure to provide genetically all that it needs in order to flourish and continue. Non-human natures, on the other hand, are genetically adequate for their own needs, including the need to reproduce in kind. In comparing such natures to craft, Aristotle prescind from just the feature of craft that so impressed Socrates and Plato: the craftsman's command of the *reasons* for doing as he does.

(17) The crafts develop; and even when a craft is well worked out, further intelligence is often needed to apply it effectively. There is room for thoughtfulness, inventiveness, and an exploratory attitude to facts and objectives. With nature, by contrast, it is as if the objective has never not been finally formulated and the means completely known. Thus when Aristotle likens nature to the craftsman, he has in mind the craftsman as *already effectively in action*, and leaves out of sight the processes, with all their doubtfulness, trial and error, by which someone sets himself up so as to be thus effective: whether by learning a skill, or by analysing the objective, or by taking closer stock of the facts. It is perhaps at this stage that distinctively *mental* activity is most apparent. We wonder and deliberate, not yet being ready to act with the assurance of those whose knowledge is totally immanent in their action. The thinking in action of the utterly accomplished performer is not alongside, above, beyond or even about his performance: but is that performance. It is the exercise of *achieved* craft that Aristotle has in mind when he compares craft with nature. The danger of the analogy is not that it will psychologise the concept of nature, but that it will de-psychologise the concept of craft.¹⁷ For there is no distinguishable psychological dimension to the self-contained perfection of craft that figures in the analogy. This ideal efficiency essentially (if

(17) However, this remark should be balanced by the observation that in the *Ethics* Aristotle treats craft as a paradigm for practical reflection. It is only in the *Physics* (see note 12) that he says that craft does not deliberate.

it is the efficiency of *craft*) rests on a great deal that is not itself; but to acknowledge these other aspects would be to destroy the analogy.

(18) These considerations may set us wondering whether the analogy's true direction is not the reverse of what it seems. If, as I have suggested, the notion of craft presented here is a false abstraction, then we are not dealing with a familiar concept of craft at all. Nor is it easier to understand than that for which it is supposed to be the model. Even the term "craft" is a misnomer, since the true referent here is not human craft as we actually find it, but end-directed automation. What more telling example of this could Aristotle show than the natural activity of organisms? Taken in its usual sense, the craft-analogy fails; but perhaps this argument shows that it was not needed in the first place. Could we even make sense of what passes for craft in the context of the analogy if we did not already grasp the idea of a type of teleological functioning that needs no roots in reflection?

DE LA PHRONESIS ANIMALE

JEAN-LOUIS LABARRIÈRE

Aristote qualifie souvent les animaux, ou du moins un certain nombre d'entre eux, de *phronimoi*, mais il ne définit jamais clairement ce qu'il entend par là. On s'accorde généralement pour dire, en première approximation, qu'il désigne par *phronèsis* un certain type de connaissance et un certain type de comportement qui, tous deux, dépassent les produits de la simple sensation. Le célèbre début de la *Métaphysique* ferait ainsi écho à ce passage de l'*Éthique à Nicomaque* où Aristote mentionne que « certaines des bêtes sont dites prudentes (*lôn thèriôn enia phronima phasin einai*) » parce qu'« il apparaît qu'elles possèdent une faculté de prévoyance à propos de leur propre vie (*peri ton aulôn bion echonta phainetai dynamin pronoèlikèn*) » (VI, 7, 1141a26-28).

Ma question sera simple : quelle est la nature de ce qui « apparaît » ainsi et comment cela apparaît-il ? Quel type de connaissance et quel type de comportement une telle *phronèsis* implique-t-elle par différence d'avec les animaux qui en seraient privés ? Quel rapport cette *phronèsis* entretient-elle avec celle des humains ? Je conduirai cette analyse en deux temps : Tout d'abord, je m'efforcerai de construire un « idéal-type » de la *phronèsis* animale afin de chercher à en éclairer la nature — question que, me semble-t-il, nous ne pouvons éviter, même si Aristote n'en traite pas *ex professo* —, puis je tenterai de vérifier la pertinence de cette construction en analysant les comportements animaux qu'Aristote qualifie explicitement d'intelligents et/ou prudents.

Deux ensembles de remarques s'imposent toutefois préalablement afin de nous garder de toute interprétation globalisante. Le premier sera relatif au lexique utilisé par Aristote dans les traités zoologiques. En effet, sa souplesse, mais aussi sa richesse, interdisent de le rigidifier, d'où l'impression d'un vocabulaire fluctuant, apparemment peu rigoureux, impression renforcée, nous le verrons, par un fréquent usage de termes traditionnels pour désigner des qualités ou défauts conventionnellement

attribués à tel ou tel animal. Remarquons donc tout d'abord qu'en ces traités le Stagirite semble employer indifféremment, pour ne pas dire synonymement, les termes *phronèsis* et *synesis* pour désigner « l'intelligence pratique » des animaux¹. Or, lorsqu'il s'agit des humains, il distingue la *phronèsis* dite *epilaklikè*, « impérative », de la *synesis* « seulement critique », *krilikè monon*². Qu'est-il donc advenu de cette distinction pour les animaux ? La question s'aiguise même dès lors que l'on se souvient que dans la *Polilique*, Aristote fait de la *phronèsis* la qualité propre au gouvernant (*archonlos*) et non au gouverné, le premier étant comparable au flûtiste qui se sert (*chrômenos*) de la flûte et non au luthier, comparable, lui, au gouverné³. S'il est sans doute vain, au nom d'une rigueur à mon sens ici hors de propos, de s'efforcer de retrouver de telles distinctions chez les animaux, il n'en reste pas moins, tel sera mon propos, que certains des caractères de la *phronèsis* humaine sont, sous des modalités que je préciserai par la suite, transférables aux animaux doués de *phronèsis-synesis*. Ainsi, quand bien même les textes ne permettent pas de distinguer à leur propos la *phronèsis* de la *synesis*, leur *phronèsis* ou *synesis* renvoie sans doute à un quelconque pouvoir de commandement et il n'est peut-être pas interdit de penser que chez eux l'*aisthèsis* puisse jouer ce rôle de faculté « seulement critique ». Néanmoins, malgré un tel usage, le terme *phronèsis* peut fort bien continuer à ne désigner que la « prudence » un peu timorée des animaux réputés lâches (*deilos*), ainsi du cerf (*elaphos*) et du lièvre (*lagôs*, *dasupous*), caractère dû physiologiquement autant à l'extrême fluidité de leur sang qu'à la grosseur de leur cœur⁴.

Remarquons ensuite que bien que nombreux soient les passages du *corpus* privant les animaux de *dianoia*, de *nous*, ou bien de *logismon* et bien sûr de *logos*⁵, soit de raisonnement *en lanl que lel*, nombreux sont également ceux des traités zoologiques employant, que ce soit directement ou indirectement dans des expressions dérivées, le terme *dianoia* et même celui de *nous* pour désigner la pensée ou intelligence animale⁶. Or, si l'on veut que ces emplois ni ne contredisent brutalement le reste du *corpus*, ni n'aient un sens trop vague ou purement métaphorique, alors il faut bien se résoudre à ce que Aristote désigne par là quelque chose qui

(1) Cf. pour la *phronèsis*, p. ex. *H.A.*, IX, 5, 611a16; 6, 612a3, 612b1; *P.A.*, II, 2, 648a6, 8, 10; *G.A.*, III, 2, 753a11-12... Pour *synesis* : *H.A.*, VIII, 1, 588a24, 29, 589a1; IX, 46, 630b21...

(2) Cf. *E.N.*, VI, 11, 1153a8-10.

(3) Cf. *Pol.*, III, 4, 1277b25-30.

(4) Cf. *H.A.*, I, 1, 488b15; *P.A.*, II, 4, 650b14-30; III, 4, 667a10-21.

(5) Cf. *De An.*, II, 3, 415a7-11; III, 3, 427b6-14, 428a22-24, 429a6; 10, 433a11-12; *Meta.*, A, 1, 980b27 et ss.; *Pol.*, VII, 13, 1332b3-5...

(6) Cf. pour *dianoia* p. ex. *H.A.*, IX, 7, 612b20; 17, 616b22, 30... Pour *nous* : *H.A.*, IX, 3, 610b22, voire *P.A.*, II, 2, 648a4-5.

dans la pensée animale permette de parler d'une *phronèsis* en un sens suffisamment fort, quitte à relever par là suite son anthropomorphisme. En d'autres termes, il faut admettre, me semble-t-il, que Aristote vise par là *quelque chose comme* un « raisonnement ». Certes ce n'est ni le *logismon* de cette partie de l'âme logique qu'il nomme *lo logislikon*, « calculatrice »⁷, et encore moins le *sylogismos* scientifique, mais c'est bien, s'il faut en croire ce qui est dit de la *phanlasia* dans le *De Anima*, III, 10, 433a10-14, « quelque chose comme une pensée » (*hôs noèsin tina*), laquelle sorte de pensée est « pratique » (*ho praklikos*) puisqu'elle « calcule en vue d'une fin » (*nous de ho heneka lou logizomenos*). Étant donné que cela vaut aussi et surtout pour les animaux⁸, privés dans ce même passage de *noèsis* et de *logismon*, tout tient donc à la valeur que nous attachons à ce *hôs*. Nous le retrouverons lorsqu'à propos des dauphins fonçant vers la surface, Aristote écrit qu'ils retiennent leur souffle *hôsper analogisamenoi* « comme s'ils calculaient » la distance ou le temps qui leur reste (*H.A.*, IX, 48, 631a27). Le problème sera le même lorsqu'il s'agira des « nombreuses imitations » (*polla mimemala*) de la vie humaine chez les petits oiseaux qui montrent ainsi « la précision de leur raisonnement » (*tên tês dianoias akribēian*, *H.A.*, IX, 7, 612b18-21). Plus généralement, ainsi que nous le verrons *infra* avec l'*H.A.*, VIII, 1, c'est tout le problème de l'analogie.

Ma dernière remarque relative au vocabulaire d'Aristote portera tout autant sur sa richesse que sur son caractère souvent traditionnel : *panourgia*, *eumèkhanos*, *eubiolos*, *ergalikos*, *lekhnikos*, sont autant de termes fréquemment employés par Aristote⁹ et que, d'Homère à Oppien, les Grecs utilisèrent pour qualifier des comportements intelligents. Plus particulièrement, ils s'en servirent pour désigner cette sorte d'intelligence rusée qu'ils nommaient *mélis* et dont nous devons à la sagacité de

(7) Cf. *E.N.*, VI, 2, 1139a11 et ss. On se souviendra que cette « partie » est aussi nommée *lo doxastikon* en VI, 13, 1144a14, ou bien encore *lo bouleutikon* dans le *De An.*, III, 10, 433b3 et 11, 434a12.

(8) En rapprochant la recherche du désirable de la recherche du bien pratique, Aristote tient en effet par là le principe d'une explication unitaire du mouvement animal (et humain) et de l'action humaine, en même temps que le principe de leur différence grâce à la distinction entre la *phantasia aisthèlikè* et la *phantasia logislikè-bouleutikè* opérée dans le *De An.*, III, 11. Cf. sur ce point D. J. Furley, *Self Movers* et J. B. Skemp, *Orexia in De Anima III 10*, dans G. E. R. Lloyd & G. E. L. Owen, *Aristotle on mind and the senses, Proceedings of the seventh Symposium Aristotelicum*, Cambridge, 1978; M. C. Nussbaum, *Aristotle's De Motu Animalium*, Princeton, 1978; J.-L. Labarrière, *Imagination humaine et imagination animale chez Aristote, Phronesis*, XXIX-N° 1, 1984.

(9) Les références sont très nombreuses, en voici seulement quelques-unes tirées de l'*H.A.* *Panourgia* : I, 1, 488b20; IX, 8, 613b23; 37, 621b29. *Eumèkhanos* et *eubiolos* : IX, 7-36, 614b34, 615a18, 616b10, 11, 13, 20, 27, 34, 620a21... *Tekhnikos* : IX, 11, 615a19; 13, 616a4; 34, 619b23; 36, 620b10... *Ergalikos*, *ergasia*, *ergazonlai* : IX, 38-43, 622b19, 24, 26; 623b26, 624b31, 627a6, 9... Notons encore qu'une des trois sortes d'araignées est dite *sophôlaton*, 623a8.

M. Détienne et J.-P. Vernant de nous avoir montré les multiples tours¹⁰. Reste à savoir comment apprécier l'usage qu'en fait le Stagirite. Certes, doter les oiseaux d'une intelligence fine et «familiale» n'avait rien de bien original ainsi qu'en témoignent ces vers de l'*Électre* de Sophocle :

« Parmi les oiseaux du ciel, quand nous voyons les plus intelligents (*phronimôtalous*) prendre soin de nourrir ceux dont ils ont reçu la vie et les bienfaits qui soutiennent la vie, pourquoi nous les humains, pourquoi d'ingratitude payons-nous nos parents? » (1058-1061).

Mais, faut-il pour autant supposer qu'Aristote ne se dégage de cette tradition que fort difficilement, même lorsqu'il s'y oppose, et qu'il paye ainsi sa dette au folklore ainsi que tend à le soutenir G. E. R. Lloyd ?¹¹. Dès lors, les traités zoologiques du Philosophe, lorsqu'ils dotent les animaux de *phronèsis* ou gratifient tel ou tel animal de tel ou tel caractère, seraient en contradiction avec les forts énoncés de l'*Éthique à Nicomaque* selon lesquels il ne saurait y avoir d'animal vertueux¹². Mais, durcir ainsi le trait, serait oublier, J. G. Lennox l'a fait remarquer¹³, qu'il n'est pas interdit d'en parler métaphoriquement, c'est-à-dire en un sens moins strict, ce que fait précisément Aristote dans sa zoologie.

Or c'est bien cet usage qui m'intéresse ici. Autrement dit, plutôt que de me demander ce qu'il en est de la teneur des propos d'Aristote en les rapportant à ceux de ses prédécesseurs ou aux «on dit» qui avaient cours et en comparant ses intentions affichées avec le tribut qu'il paye au folklore et à l'idéologie, je me demanderai, sans pour autant méconnaître le contexte mais en le mettant entre parenthèses, ce qu'il en est dans les textes mêmes du Stagirite. Plus précisément, ma question sera celle-ci : quand bien même Aristote payerait un certain tribut à la tradition, quand bien même les livres VIII et IX de l'*H.A.* seraient marqués par un net anthropocentrisme et anthropomorphisme qui a pu faire douter de leur authenticité¹⁴, il n'en resterait pas moins que

(10) Cf. *Les ruses de l'intelligence. La mêtis des Grecs*, Flammarion, Paris, 1974.

(11) Cf. *Science, Folklore and Ideology*, Cambridge, 1983, p. 18-43.

(12) Cf. *E.N.*, III, 4, 1111b6 et ss (ou *E.E.*, II, 10); VII, 5, 1147b3-5; VII, 7, 1149b31-1150a1.

(13) Cf. *Demarcating Ancient Science. A discussion of G.E.R. Lloyd; Science, Folklore and Ideology*, dans J. Annas, *Oxford Studies in Ancient Philosophy*, vol. III, Oxford, 1985, p. 307-324.

(14) P. Pellegrin, alors même qu'il étudie les notions de genre, d'espèce, et de différence spécifique, a lui aussi insisté sur l'anthropocentrisme aristotélicien qui se révèle à travers sa doctrine de l'analogie, cf. *La classification des animaux chez Aristote*, Paris, 1982, p. 73-137 et plus particulièrement p. 103-114. En ce qui concerne l'authenticité des livres VIII et IX de l'*H.A.*, malgré le récent article de P. Huby tenant pour leur inauthenticité et s'efforçant de montrer ce qu'ils doivent à Théophraste, cf. Theophrastus in the Aristotelian Corpus, with particular reference to Biological Problems, dans A. Gotthelf, *Aristotle on Nature and Living Things*, Pittsburgh-Bristol, 1985, avec G. E. R. Lloyd, *op. cit.* p. 21, je me rallie aux arguments particulièrement convaincants de D. M. Balme, *Aristotle's Historia Animalium: date and authorship*, 1981 (inédit).

l'interprète doit s'interroger sur la cohérence des différents énoncés au sein du *corpus* et ne pas précipiter les réponses. Ainsi par exemple, malgré le caractère traditionnel d'un certain nombre de termes pour désigner l'intelligence animale, rien n'assure *a priori* qu'ils renvoient à une même qualité également ou plus ou moins partagée par un certain nombre d'animaux. Peut-être richesse et souplesse ont-elles pour fin de signifier qu'il serait préférable de parler de *phroneseis* animales. Pour parler comme Descartes, gardons-nous donc de toute *praecipitatio* et de toute *praevenlio*.

Ma deuxième grande remarque préliminaire sera une nouvelle fois relative aux expressions mêmes dont use Aristote. En effet, lorsqu'Aristote mentionne sans plus s'y arrêter l'existence d'une *phronèsis*, c'est bien souvent au sein d'une échelle et il emploie alors des comparatifs. C'est le cas des fameuses premières lignes de la *Métaphysique* où les animaux doués de mémoire sont dits «plus intelligents» (*phronimôtera*) que ceux doués seulement de sensation. Certains seront d'ailleurs non seulement plus intelligents mais encore «plus doués pour apprendre» (*malhèlikôtera*) s'il sont de surcroît doués d'ouïe, ce qui n'est pas le cas de tous les animaux doués de mémoire, ainsi de l'abeille et des autres animaux du genre¹⁵. C'est aussi le cas dans l'*Histoire des Animaux*, VIII, 1, 589a1-2, où, concluant un passage consacré à la reproduction et à l'élevage des petits, Aristote écrit que vivent d'une façon plus politique (*polilikôteron*) avec leurs petits, ceux qui sont doués de mémoire et sont «plus intelligents» (*synelôtera*). C'est encore plus évident dans un passage parallèle de la *Génération des Animaux* où en III, 2, 753a7-17, le Stagirite établit entre les animaux une gradation relative aux sentiments et aux soins qu'ils portent à leurs petits : seuls les «plus intelligents» (*phronimôtera*) s'intéressent à leurs petits jusqu'à ce qu'ils soient élevés, et ceux qui «participent le plus à l'intelligence» (*malista koinônousi phroneseôs*) conservent des habitudes en commun et de l'amitié (*synêtheia kai philia*) avec leurs petits une fois cet élevage terminé. C'est le cas des hommes et de certains quadrupèdes, mais non des oiseaux¹⁶.

La *phronèsis* animale semble donc susceptible de degrés et, s'il y a des animaux plus intelligents que d'autres, cela doit signifier que les animaux inférieurs ne sont pas totalement dénués d'intelligence mais qu'ils en ont moins — au demeurant, l'*aislèsis* n'est-elle pas déjà une

(15) Une fâcheuse habitude assimile souvent les animaux *mathèlika* et les animaux *hèmèra*. Il n'en est rien : si les *hèmèra* sont des *mathèlika*, tel n'est pas le cas de tous les *mathèlika*, ainsi que le souligne l'*H.A.*, IX, 1, 608a17-21, qui attribue la *mathèsis* et la *didaskalia* aux animaux certes doués d'ouïe, mais en soutenant qu'ils «apprennent» aussi bien des hommes que de leurs semblables.

(16) On trouve des formules voisines pour désigner l'intelligence des biches : *hè elaphos ouch hèkista dokei einai phronimon*, *H.A.*, IX, 611a15-16. De son côté, l'éléphant a une intelligence «hyperbolique», 46, 630b21.

dynamis kritikè? A l'inverse, parmi ces animaux plus intelligents, certains le sont encore plus que d'autres, et leurs capacités sont perfectibles grâce à l'ouïe. Ajoutons encore que la *phronèsis* ou *synesis* animale a affaire, même faiblement, à l'expérience et à l'habitude (*Méta.*, A, 1, 980b27; *Pol.*, VII, 13, 1332b4), ce que souligne, dans l'*H.A.*, VIII et IX, aussi bien la richesse du vocabulaire dont se sert Aristote pour désigner l'intelligence des animaux que l'attention qu'il porte aux sentiments «communautaires» des animaux.

Or, s'il existe un lien entre le développement de l'intelligence et celui des habitudes familiales, les choses deviennent nettement plus embrouillées car les diverses hiérarchies ne se superposent pas aisément. Ainsi, les quadrupèdes qui, avec les hommes, sont les animaux les plus intelligents¹⁷, ne sont pas nécessairement (bien qu'un certain nombre d'entre eux s'approprient facilement) les animaux qui ont l'ouïe la plus fine et la voix la plus déliée : ils sont sur ce point nettement dépassés par les oiseaux (*P.A.*, II, 17, 660a14-b11). Or les oiseaux passent pour s'attacher moins longtemps à leurs petits et être moins intelligents que les quadrupèdes, bien que ce soit chez les plus petits d'entre eux que l'on trouve, nous l'avons déjà vu, de «nombreuses imitations» (*polla mimèmata*) de la vie humaine ainsi que «la sûreté du raisonnement» (*tèn tèn dianoias akribèian*). Il y a donc bien là «des choses à rechercher» et il faudra user, pour parler une nouvelle fois comme Descartes, de *circumspectio*.

I. Logikòs

Qu'en est-il donc de la nature et du statut de cette intelligence animale? D'emblée nous nous trouvons confrontés à un épineux problème puisque, aussi surprenant que cela puisse paraître, il semble bien que l'intelligence animale entretienne avec celle des humains une double relation : celle d'une ressemblance modulée selon l'ordre du plus au moins et celle, bien connue, de l'analogie. En effet, l'*H.A.*, VIII, 1, 588a16-b3, situe la *synesis* à ces deux niveaux d'analyse :

« Il y a, en effet, chez la plupart des autres animaux, des traces des états de l'âme (*ichnè tòn peri tèn psychèn tropòn*) qui, chez les hommes, présentent des différences plus manifestes (*phanèroteras tas diaphoras*). En effet, docilité et sauvagerie, douceur et rudesse, courage et lâcheté, crainte et témérité, emportement et fourberie, et (une ressemblance) de l'intelligence à l'égard du raisonnement (*tès peri tèn dianoian syneseòs*) sont des ressemblances (*homoiotètes*) avec l'homme qui existe chez beaucoup d'animaux, comme ce dont nous avons parlé à propos des parties

(17) Nous verrons par la suite que cela vaut aussi des vivipares tels les dauphins ou les phoques.

organiques. Car certains (états) (*ta men gar*) diffèrent selon le plus et le moins (*tôi mallon kai hèllon diapherei*) à l'égard de l'homme, et il en va de même pour l'homme à l'égard de beaucoup d'animaux (en effet certains de ces états (*enia gar tòn loioulòn*) existent plus chez l'homme, d'autres au contraire (*enia de*) plus chez les autres animaux), d'autres au contraire (*ta de*) diffèrent selon l'analogie (*tôi analogon diapherei*) : comme il existe chez l'homme art, sagesse et intelligence (*lekhnè kai sophia kai synesis*), ainsi existe-t-il chez certains animaux quelque autre faculté naturelle de même sorte (*tis hētera toioutè physikè dynamis*). » (trad. J.-L. L.)

S'il semble légitime de privilégier la relation analogique, reposant sur une différence de nature et non de degré puisque les animaux sont par définition privés du *logistikon* humain, il n'en reste toutefois pas moins que «l'intelligence relative au raisonnement» fait partie des ressemblances susceptibles de degré. C'est bien là ce qui est surprenant pour qui ne retiendrait que l'existence d'une certaine faculté naturelle permettant à certains animaux de présenter un *analogon* de *lekhnè*, de *sophia* et de *synesis*, mais c'est pourtant ce qu'écrit aussi Aristote dans la parenthèse des lignes 27-28 : le balancement qu'on y observe en *enia gar...enia de* renvoie bien aux «traces des tropes de l'âme» des lignes 19-20. Or ces «qualités psychologiques», qui comprennent l'énigmatique expression au génitif *tès peri tèn dianoian syneseòs*, sont, dit alors Aristote, des ressemblances susceptibles, selon les cas, de différer *en degré* des hommes aux animaux et inversement. Ce balancement en *enia gar...enia de* me semble rendre donc très délicat toute interprétation du balancement général en *ta men...ta de* (lignes 588a25-31) qui réserverait la première branche aux «caractères», alors seuls susceptibles de degré, et la seconde aux «facultés intellectuelles», susceptibles seulement d'analogie.

Au demeurant, dès lors qu'il s'agit d'animaux, exclure ce qui concerne les facultés intellectuelles de ce qui concerne les caractères (*èthè*), ne semble pas correspondre à la démarche du Stagirite lui-même. Remarquons en effet, avant même d'en venir à cet analogue de faculté, que l'inclusion ici opérée par Aristote — aussi difficile soit-elle à interpréter — n'est nullement unique. Je n'en prendrai que deux exemples. Dans l'*H.A.*, I, 1, 488b12-28, lorsqu'il énumère et hiérarchise «les différences relatives au caractère» (*diaphorais kala to èthos*), I. 12), Aristote n'hésite pas à dire que seul l'homme est délibérateur (*bouleutikon monon*, I. 24) tandis que d'autres animaux que lui sont aussi doués de mémoire et de la capacité d'apprendre (*mnèmès kai didakès*, I. 25). Et il conclut ce passage en écrivant qu'il reviendra sur cette étude des caractères et des manières de vivre (*peri ta èthè kai tous bious*, I. 27), ce qu'il aborde dans les livres VIII et IX d'où sera tiré mon deuxième exemple. Dans les premières lignes du livre IX, Aristote compte en effet la *phronèsis*, au même titre que le courage ou la douceur, parmi les *èthè* ou les *pathèmata* possédés par les animaux en raison de l'existence en eux d'une «certaine faculté naturelle» (*tina dynamin physikèn*, 608a13-17).

Nous voici donc ramenés à cette «faculté naturelle». Toutefois, alors qu'en VIII, 1, elle ne semblait postulée qu'en vue de l'existence chez certains animaux d'un *analogon* de *lekhnè*, de *sophia* et de *synesis*, elle est dite, en IX, 1, exister chez les animaux afin qu'ils possèdent des affections correspondantes à celles des humains. Que son extension soit alors plus grande ne fait qu'aviver notre problème puisque nous venons de voir qu'une lecture attentive des premières lignes de l'*H.A.*, VIII, 1, tendait à montrer que quelque chose de relatif à la *synesis* sur le plan de la *dianoia* pouvait, comme d'autres «tropes», différer en degré des hommes aux animaux. Le chevauchement et l'entrecroisement de ces textes me semblent donc montrer en un premier temps, quand bien même la relation analogique devrait être privilégiée, et conséquemment la différence de nature, que le statut de la *phronèsis* ou *synesis* animale ne va nullement de soi puisqu'il semble bien que l'on puisse en parler à deux niveaux ou de deux façons.

Si maintenant nous nous tournons de nouveau vers cette faculté naturelle telle qu'elle est présentée en VIII, 1, qu'en est-il? Le *la de* de 588a28 répondant au *la men* de la ligne 25, introduit donc que certaines qualités n'ont chez les animaux qu'un rapport d'analogie avec celles des humains. Aristote ne les énumère pas, mais il se contente d'en donner un exemple valant pour *certain*s animaux (*enios lôn zôôn*, l. 30) : il existe chez ceux-là quelque autre faculté naturelle de même sorte que ce qui chez l'homme lui permet d'être doué de *lekhnè*, de *sophia* et de *synesis*. Remarquons tout d'abord qu'à l'indétermination de cette faculté en correspond une autre de nature différente : celle relative aux animaux doués de cette faculté. Bien qu'aucun animal ne soit en tout ce passage explicitement mentionné, on ne peut qu'être attentif à un certain décalage puisque ce qui était dit auparavant des ressemblances et de la différence du plus au moins semblait valoir pour un grand nombre d'animaux (*pros polla*, l. 26), ou, par opposition à l'homme, pour les autres animaux en général (*en tois allois zôois*, l. 28), voire, si l'on remonte aux «traces», pour la plupart des autres animaux (*en tois pleislois kai lôn allôn zôôn*, l. 19), or il s'agit maintenant de *certain*s animaux (*enios*, l. 30). Certes, cet indéfini pourrait avoir une valeur voisine de celle des deux *enia* de la ligne 27, mais il semble plus raisonnable d'admettre qu'il introduit une «certaine» restriction : tous les animaux ne possèdent sans doute pas une telle faculté bien développée, et ceux qui la possèdent manifestement ne sont peut-être pas légion. De là un *enios* et non un *pleislois*, quand bien même il n'y a peut-être là qu'un effet de la difficulté à connaître le caractère des animaux difficiles à étudier (*H.A.*, IX, 1, 608a11-13).

Reste maintenant à préciser la nature de cette faculté analogue et, partant, l'intelligence pratique des animaux qui en sont doués. Si, comme y invite Aristote, nous nous tournons vers l'*H.A.*, I, 1, 486a14-

b24, où il explicite les différentes sortes de ressemblances entre les parties du corps, nous devons nous souvenir qu'il en existe trois sortes : soit les parties se ressemblent par leur forme à l'intérieur d'une même espèce (un nez ou un œil d'homme à un autre nez ou autre œil d'homme); soit elles se ressemblent en différent par excès ou défaut à l'intérieur d'un même genre (certains oiseaux ont le bec long, d'autres court); soit enfin elles ne se ressemblent ni spécifiquement, ni selon l'excès et le défaut, mais par analogie (l'arête est l'analogue de l'os). Il existe donc chez certains animaux une faculté naturelle jouant la même fonction que l'art, la sagesse et l'intelligence chez l'homme, mais, bien que naturelle, elle ne saurait être de même nature que ce qui joue ce rôle chez l'homme, ni par conséquent différer selon le plus ou le moins avec celle de ce dernier. Voilà qui devrait être clair si, d'une part, nous n'avions déjà vu que ce qui a trait à la *synesis* sur le plan de la *dianoia* pouvait être classé parmi les caractères semblables susceptibles de différer en degré, et si, d'autre part, cette faculté naturelle ne s'appliquait qu'aux facultés intellectuelles, ce qui, d'après l'*H.A.*, IX, 1, 608a13-17, n'est pas.

D'un autre côté, les choses ne sont pas vraiment plus claires si l'on se penche vers ces caractères différant selon le plus et le moins. En effet, d'après l'*H.A.*, I, 1, 486a21-b17, ce qui diffère selon l'excès et le défaut (le plus et le moins pouvant être considérés comme tels) diffère à l'intérieur d'un même *genos*. Comment donc, en toute rigueur, une telle définition pourrait-elle s'appliquer à la comparaison des caractères entre les humains et tel ou tel genre animal? Nous pouvons sans doute déduire de là tout autant le privilège souvent accordé à l'analogie que les critiques adressées à Aristote pour son manque de rigueur en zoologie. Cependant le terme *genos* étant susceptible d'une plus ou moins grande extension, rien n'interdit de continuer à parler assez rigoureusement si, pour que la différence selon le plus et le moins reste à l'intérieur d'un même genre, on entend par *genos* ce qui désigne le genre animal, doué de sensibilité, par opposition au genre végétal dépourvu de sensibilité. Cela, à condition de sous-entendre que l'on parle alors des caractères en un sens moins rigoureux que dans les *Éthiques* puisque l'on sait qu'Aristote refuse à l'*aisthèsis* d'être au principe d'une quelconque action en tant que telle parce qu'elle est commune aux humains et aux animaux (*E.N.*, I, 6, 1098a2-3; VI, 2, 1139a18-20).

Reconnaissons toutefois que la rigueur ainsi donnée à la différence selon le plus et le moins ni n'éclaire ce qu'il en est de cette faculté «analogue», ni n'indique quels pourraient être les animaux à qui elle appartient au premier chef. C'est pourquoi, afin de mettre en rapport ces deux sortes de ressemblances et afin de préciser de quels animaux il s'agit, nous pourrions supposer, puisque ce qui est dit des «traces des qualités psychologiques» doit avoir des animaux pour support, que le

genos au sein duquel s'exerce la différence selon le plus et le moins, renverrait non au genre animal en général mais au genre des sanguins, tandis que ce qui est dit de l'*analogon* vaudrait pour les non-sanguins. Voilà qui expliquerait que nous pourrions trouver la *synesis* des deux côtés de l'alternative ouverte par le balancement en *la men ... la de*. Nous pourrions dès lors comprendre ce passage parallèlement à celui des *P.A.*, II, 2, 648a2-11, qui rapporte les qualités de la sensibilité ou de l'intelligence à celles du sang ou de ce qui en tient lieu :

« Un sang plus épais et plus chaud donne plus de force, tandis qu'un sang plus léger et plus froid donne plus de sensibilité et d'intelligence (*aisthèlikôteron kai noêrôteron*). La même différence se retrouve dans les humeurs qui correspondent au sang. C'est pourquoi les abeilles et les autres animaux de cette espèce sont doués de plus d'intelligence (*phronimôtera*) que bien des animaux sanguins et, parmi ces derniers, ceux dont le sang est froid et léger sont plus intelligents (*phronimôtera*) que ceux dont le sang a les qualités contraires. Mais le mieux est encore d'avoir le sang chaud, léger et clair : car les animaux ainsi faits sont doués à la fois de courage et d'intelligence. » (trad. P. Louis).

Pourtant, aussi commode soit ce rapprochement, il ne me semble pas vraiment probant. En effet, outre son caractère éminemment conjectural (rien en ce passage de l'*H.A.* n'est dit à propos de cette différence entre sanguins et non sanguins), une telle hypothèse entraînerait que seuls les non-sanguins seraient doués d'une telle faculté naturelle « analogue » à ce qui chez les humains est art, sagesse et intelligence, tandis que ceux qui se différencieraient de ces derniers selon le plus et le moins, c'est-à-dire les sanguins, n'auraient que des traces de *synesis*. Voilà qui semble fort improbable puisqu'il existe de nombreux animaux sanguins intelligents, quand bien même l'abeille ou la fourmi dépassent en intelligence les sanguins au sang épais (p. ex. les taureaux et les sangliers, *P.A.*, II, 4, 650b33-651a4). Remarquons en revanche que dans ce passage des *P.A.* les comparatifs permettent de mettre en rapport la différence de nature (selon l'analogie) et la différence de degré (selon le plus et le moins) puisque des animaux possédant un analogue de ceci ou de cela peuvent être dits supérieurs à certains de ceux qui diffèrent selon le plus et le moins.

On le voit donc, les choses sont nettement plus complexes qu'il ne pourrait sembler au premier abord. Il semble bien que l'on puisse parler de la *phronèsis* ou de la *synesis* à deux niveaux d'analyse, celui de la différence ou ressemblance selon le plus ou le moins et celui de la différence ou ressemblance selon l'analogie, niveaux entrecroisés avec ceux des caractères et des facultés. En effet, tandis que l'*H.A.*, VIII, 1, 588a28-31, semble réserver à une *physikè dynamis* indéterminée la fonction de présenter chez certains animaux un analogue de ce qui chez l'homme est art, sagesse et intelligence, l'*H.A.*, IX, 1, 608a13-17 semble de son côté ouvrir les fonctions de cette faculté naturelle puisqu'elle

permet alors aux animaux de présenter des *pathêmata* et des *hexeis* correspondant à chacun (*hechaslon*) de ceux des humains. Les qualités ou défauts par lesquels humains et animaux diffèrent selon le plus et le moins, peu importe ici l'intensité de ces « traces », peuvent donc être également rapportés à cette faculté naturelle.

De là la possibilité de généraliser l'analogie afin de ne pas parler seulement par métaphore ou seulement selon une tradition folklorique : c'est en fonction d'une certaine faculté naturelle, semble-t-il plus ou moins bien partagée chez les animaux, que l'on peut, à leur propos, parler de caractères et de qualités intellectuelles. Mais à l'inverse, de là aussi, une fois cela entendu et si nous nous souvenons qu'hommes et animaux sont précisément des animaux et non des plantes, que l'on puisse en parler en terme de degré puisque nous nous situons alors au niveau d'une psychologie biologique et non au niveau d'une psychologie morale¹⁸. C'est en ce sens, me semble-t-il, qu'il faut comprendre l'inclusion de la *synesis* relative à la *dianoia* au sein des qualités pouvant différer en degré, inclusion plus nette encore, je viens de le rappeler, au début de l'*H.A.*, IX, 1.

Toutefois, quand bien même certains des effets de la *phronèsis* animale peuvent, selon des modalités certes complexes, être comparés à ceux de la *phronèsis* humaine, il n'en reste pas moins que la *phronèsis* animale ne saurait être que fort différente de la *phronèsis* humaine puisque les animaux, quels qu'ils soient, sont privés d'*hypolêpsis* et de *bouleusis*. A strictement parler, je l'ai déjà mentionné, la *phronèsis* animale ne préside à aucune *praxis*. Nous verrons cependant plus loin, nouvel exemple de la souplesse du vocabulaire aristotélicien, que le Philosophe n'hésite pas à parler de *praxeis* animales quand il entend désigner des « actes » ou « actions » dépassant le strict mouvement local. Il en va ainsi de ce qui a trait à la recherche de la nourriture, à leur conservation et à la protection de leur progéniture, autant d'actes qui manifestent souvent des comportements intelligents, voire « rusés ». On ne saurait donc tenir la *phronèsis* animale pour une simple métaphore, d'autant qu'un certain nombre d'animaux sont « plus prudents » que les humains, par exemple dans leur capacité à prévoir le temps qu'il fera (ainsi des abeilles, *H.A.*, IX, 40, 627b10-13). C'est pourquoi il me semble juste, en un premier temps, d'en construire un « idéal-type » en transposant *mulalis mulandis* à la *phronèsis* animale certains des caractères de la *phronèsis* humaine.

En premier lieu l'intelligence animale ajoute à l'*aisthêsis* son propre pouvoir de discrimination lié aux *phantasmata* de la *mnêmê* et de la *phantasia*. D'après le *De An.*, III, 3, 427b6-8 il ne caractérise qu'un

(18) Cf. W.W. Fortenbaugh, Aristotle : Animals, Emotion and Moral Virtue, *Arethusa*, 4, 1971, p. 137-165; Aristotle on Emotion, London, 1971, p. 26-30, 66-70.

certain nombre d'animaux et, nous l'avons vu, il peut être renforcé par la possession de l'ouïe. Autrement dit, elle implique des conduites qui ne sont pas seulement instinctives mais qui relèvent d'une sorte de raisonnement. P. ex., les dauphins lorsqu'ils poursuivent une proie, retiennent leur souffle «comme s'ils calculaient» leur temps (*hōsper analogisamenoi*, H.A., IX, 48, 631a27). De même la seiche (*sēpia*) passe pour «le plus rusé» (*panourgolaton*) des céphalopodes parce qu'elle lache son encre pour se dissimuler et non par peur, tandis que le poulpe (*polypous*) est inintelligent (*anoēton*, H.A.; IX, 37, 621b28-622a14; P.A., IV, 5, 679a4-30). Il semble en effet que nous puissions dire que de même que la seiche «utilise» (*chrētai*, 621b29; *chrēsthai*, 679a9) son encre, de même ce qui caractérise la *phronēsis* animale c'est un certain usage des sensations et de l'habitude en vue d'un certain mieux-vivre et non du seul survivre.

Le *De Sensu*, I, 436b12-437a17, distingue ainsi deux fonctions, pour les animaux doués du mouvement local, des sens «externes», savoir l'odorat, la vue et l'ouïe. D'une part, ils existent en vue de la conservation (*sōlēria*) en guidant la recherche de l'utile et la fuite du nuisible, mais, d'autre part,

«pour ceux qui sont doués de réflexion, ces sensations leur appartiennent en vue de leur bien-être (*tois de kai phronēseōs tunchanousi lou eu heneka*) : elles leur apprennent en effet à distinguer dans les objets beaucoup de différences (*pollas ... diaphoras*), d'où leur vient la connaissance et des objets de pensée et des actions à faire (*tōn noētōn enginelai phronēsis kai hē tōn praktōn*). De ces facultés, la meilleure, en elle-même, c'est la vue, pour les besoins nécessaires de l'animal ; mais pour l'intelligence (*pros de noun*) et accidentellement, c'est l'ouïe.» (trad. R. Mugnier).

Levons d'emblée une difficulté plus apparente que réelle : bien que la *phronēsis* appartienne aussi à certains animaux, il pourrait sembler, en raison de la connaissance qu'elle procure ici, que ceux qui en sont doués sont seulement les humains. Une telle impression pourrait être renforcée par ce que dit Aristote de l'ouïe à la fin de ce passage :

«l'ouïe ne fournit que les différences de son (*tas lou psophou diaphoras*, à la différence de la vue qui fournit des différences nombreuses et variées), et, pour quelques êtres aussi des différences de voix (*tas tēs phōnēs*) ; mais, accidentellement, elle contribue à la pensée (*phronēsin*) pour une très grande part, car le langage est la cause de l'instruction (*logos ailiōs esti tēs mathēseōs*), non en lui-même, mais indirectement : il se compose de mots (*onomatōn*), et chacun des mots est un symbole (*symbolon*).»

Cependant, malgré l'usage d'un vocabulaire caractérisant l'humain, il n'en est rien puisque l'H.A., IX, 1, 608a17-21 attribue à l'ouïe de certains animaux les mêmes pouvoirs : ils ont la capacité aussi bien d'apprendre que d'enseigner (*mathēseōs kai didaskalias*), parce que leur ouïe perçoit non seulement des différences entre les sons, mais encore entre les signes (*tōn sēmeiōn diaisthanelai tas diaphoras*). La double fonction de la vue, de l'ouïe et de l'odorat, ne caractérise donc pas

seulement les seuls humains, mais aussi les animaux doués de *phronēsis*, quand bien même c'est chez l'humain que cela est le plus évident. Qu'il y ait «recherche d'un bien» pour certains animaux est encore confirmé par le *De An.*, III, 13, où Aristote souligne que les sens autres que le toucher existent en vue du bien et non en vue de la seule vie (435b19-25).

Quelle est donc la nature de ce *lo eu* ? S'il implique un certain type de connaissance et un certain type de comportement, qui tous deux ne se réduisent pas au seul instinct de conservation, nous pouvons encore remarquer qu'il semble impliquer aussi un certain type de vie communautaire, qu'elle soit grégaire, politique, ou seulement familiale, et l'ouïe (avec la voix) vient renforcer ce lien¹⁹. Il y a lieu d'ailleurs de se demander si nous ne retrouverions pas ce *lo eu* dans le fait qu'Aristote se serve plus volontiers des termes *eumēchanos* ou *eubiotos* que des termes *mēchanos* ou *biolos* pour qualifier un certain nombre d'animaux, généralement des oiseaux. C'est ici le lieu de prendre au sérieux cet énoncé d'Aristote selon lequel on peut considérer la *phantasia aisthētikē* des animaux «comme une sorte de pensée ... pratique parce qu'elle raisonne en vue d'une fin» (*De An.*, III, 10, 433a9-21) lorsqu'elle s'unit au désir dans la recherche du désirable.

Il y a en effet deux traits de la *phronēsis* humaine qui sont transposables à la *phronēsis* animale : un certain rapport à l'expérience et le caractère impératif (*epitaktikē*). Si la *phronēsis* ou la *synesis* animale est supérieure à l'*aisthēsis*, voire à la *mnēmē* et à la *phantasia* en ce qu'elle implique un analogue de raisonnement (une sorte de pensée pratique), c'est sans doute parce qu'elle implique un certain recul par rapport aux différences perçues par l'*aisthēsis* et conservées dans la *mnēmē*. Cette «pensée» est «impérative» parce qu'elle commande en faisant usage de ce qui est proposé. Autrement dit les conduites prudentes diffèrent des conduites seulement instinctives en ce qu'un quelque chose qui *keleuei* vient s'interposer. C'est bien semble-t-il le cas de la seiche lorsqu'elle lache son encre : elle aussi a peur, mais elle se sert de cette peur et de son encre comme d'une arme. Sa ruse consiste à construire comme un rempart (*phragma*) autour d'elle en noircissant l'eau et en y revenant après avoir fait mine de fuir.

Plus généralement, les conduites «prudentes» demandent une certaine maîtrise de la temporalité afin d'agir en fonction de l'expérience tirée d'événements passés, soit en fonction d'une certaine habitude. Reste à savoir comment le passé est utilisé puisque si les animaux, ou du moins un certain nombre d'entre eux, sont doués de mémoire, ils ne sont pas doués d'*anamnēsis*, laquelle est proprement humaine car elle est

(19) Si l'*Économique* était authentique, on pourrait encore se référer à I, 3, 1343b15-18, qui fait une place aux animaux domestiques et plus intelligents en les situant entre les bêtes brutes et les humains car leur union est «plus articulée» (*diēthrōtai*).

bouleusis et *zèlèsis*. D'un autre côté, malgré leur capacité de prévoyance, ils ne perçoivent pas le futur comme les humains, puisque chez ces derniers il est objet de *doxa* (*De Mem.*, I, 449b9-15)²⁰. Au mieux, les animaux n'utiliseront que des « empreintes », mais cette utilisation relève-t-elle d'un rappel automatique ou bien d'un rappel quelque peu réfléchi ? Y aurait-il chez certains animaux participant faiblement à l'expérience et à l'habitude, quelque chose comme une « proto-réminiscence » afin qu'il y ait quelque chose comme un temps d'arrêt ?

Si les animaux ne participent que faiblement (*mikron*) à l'expérience et à l'habitude, c'est bien entendu, que l'on se fonde sur *Mela.*, A, 1, ou *An. Post.*, II, 19, parce qu'ils ne parviennent pas à unifier leur souvenir, à construire un *logos*. Ils sont donc privés d'*hypolèpsis* et il est inutile d'y revenir. Mais si cette participation faible doit être quelque chose et non un pur néant, alors cela signifie qu'ils ont un peu de ce qui constitue l'expérience en tant que telle. Par conséquent, même bornée à ce que propose la *mnèmè* et la *phantasia*, leur *phronèsis* doit opérer un certain *take-off* sans l'opérer totalement car alors les animaux sortiraient du cadre tracé par leur âme sensitive. Il faut donc supposer, si le « peu » renvoie à quelque chose et non à rien, qu'il renvoie à quelque chose comme une sorte de « sous-proposition d'empirie » parce que ces animaux-là possèdent quelque chose comme un sous-universel « stabilisé tout entier dans l'âme » (*An. Post.*, II, 19, 100a6-7). Autrement dit, en supposant qu'en 100a7 le « *lou henos para la polla* » n'ait pas son sens platonicien mais vaille pour le « *hen kala pollôn* » aristotélicien (I, 11, 77a6), ces animaux doivent posséder un « sous-universel pré-prédicatif » qui leur permet de ne pas agir à l'aveuglette et de ne pas laisser leur sort à la chance. Eux non plus ne doivent pas tomber sous le coup du mot de Polos : même faible, leur *empeiria* ne doit pas être une *apeiria* (*Mela.*, A, 1, 981a4). Toutefois, c'est la faiblesse de leur *empeiria* qui leur interdit de développer une *technè*.

Si leur simili expérience ne leur permet pas de rapporter clairement des moyens à une fin, il n'en reste pas moins, puisque ce sont des animaux supérieurs, qu'ils ont en vue quelque chose comme un « mieux-vivre » bien qu'ils ne prédisent pas à proprement parler. Ainsi, au lieu de la proposition d'empirie du style : « ce remède a guéri Callias, Socrate et quelques autres, donc il peut en guérir d'autres », peut-être ces animaux raisonnent-ils comme suit : « du frais, du vert, du fluide, une biche, donc une rivière pour étancher ma soif », cette déduction se faisant parce que la rivière a été temporellement associée au frais, au vert (des arbres), au fluide, à une biche en train de boire. Aussi, percevant certains

(20) On notera la curieuse description physiologique de ce propre humain : « L'homme est pour ainsi dire le seul à ressentir des tressaillements (au cœur) parce qu'il est le seul à espérer et à pressentir l'avenir », *P.A.*, III, 6, 669a18-20 (trad. P. Louis).

de ces éléments à distance, l'animal entreprend de se déplacer en ne laissant donc pas au hasard de ses promenades le soin de lui présenter une rivière. Il en irait de même pour des « propositions » du style : « du rouge, un cri, du rugueux, m'ont permis de construire un nid ». Très certainement, si de telles propositions étaient formulées par un humain, ce serait, comme le dit Polos, de l'inexpérience. Mais pour un animal, c'est sans doute de l'expérience car, pour effectuer ce semblant de raisonnement, il a fallu stabiliser sensations et traces sensorielles, soit marquer quelque chose comme un temps d'arrêt, c'est-à-dire faire un pas vers ce premier universel indifférencié (*slantos tôn adiaphorôn henos*, *An. Post.*, II, 19, 100a15-16) auquel les animaux n'accèdent pas en tant que tel.

En raison de la fréquente comparaison entre les enfants et les animaux, il n'est pas interdit de se demander si les animaux n'accéderaient pas à quelque chose comme ce premier universel que les enfants manifestent en appelant tous les hommes « papa » (*Phys.*, I, 1, 184b12-14). Ou bien encore n'en irait-il pas pour certains d'entre eux comme du passage de l'état d'enfance à l'état adulte puisque ce passage s'accompagne, dit Aristote, d'une stabilisation du désordonné (*Phys.*, VII, 3, 247b19-248a6) comparable à ce qui se passe lorsque l'on sort du sommeil ou de l'ivresse ? Je conviens volontiers que de tels rapprochements sont hasardeux, mais enfin lorsque la biche manifeste sa *phronèsis* en faisant ses petits sur des sentiers dégagés (*H.A.*, VI, 29, 578b16-17 ; IX, 5, 611a15-22), n'est-ce pas parce que tous les fourrés lui paraissent dangereux étant donné qu'ils peuvent abriter d'autres bêtes tandis que les chemins sont plus sûrs puisque les bêtes fuient les hommes ? Entre deux maux, les bêtes ou les hommes, la biche semble bien choisir le moindre, l'homme à ses yeux. Il y a donc bien là quelque chose comme un raisonnement impliquant un certain acte de l'âme et ce raisonnement peut être très sûr, comme chez les petits oiseaux. C'est pourquoi, si l'on se souvient qu'Aristote, dans la *Mela.* A, 1, souligne que parfois l'homme d'expérience réussit mieux que l'homme de l'art bien que ce dernier l'emporte en sagesse, il n'est pas interdit de transposer aussi aux animaux ce caractère de l'expérience. De ce point de vue, il faudrait même aller jusqu'à dire que la *phronèsis* animale puisse dépasser en intensité celle de l'homme dans la conduite de certaines actions. On comprend ainsi que l'organisation de la ruche puisse passer pour une petite merveille.

S'il est permis de pousser plus loin ces hypothèses, alors il faudrait aller jusqu'à dire que ces capacités de « raisonnement pratique » dans lesquelles la majeure du syllogisme serait une simili proposition d'empirie et non une simple « proposition d'*epithymia* », sont autant congénitales qu'acquises. La stabilisation due à un acte de l'âme serait le fruit de l'éducation et de l'expérience, autrement dit de la coutume ou

des habitudes. Toutefois, si un tel processus a lieu, il reste enfermé dans le cadre de l'âme sensitive. Aussi, lorsqu'un animal exerce un acte de *phronèsis* (c'est-à-dire lorsqu'il détermine son comportement en fonction d'un *lo eu* d'après un *ethos* acquis), cet acte, à titre d'*energeia*, est bien un acte intelligent (c'est-à-dire une position du bien), mais il faut que ce bien soit «représenté imaginativement» dans le cas particulier et telle est la fonction de la *phantasia aisthèlikè* qui, pour être supérieure à la simple sensation, y reste rattachée. Nous serions ainsi conduits à soutenir que pour que la *phronèsis* animale ait un sens, il faut qu'elle corresponde à un mouvement déclenché par l'habitude et l'expérience, et non par la seule sensation.

Remarquons cependant avant de conclure qu'une telle reconstruction suppose que la mémoire des animaux intelligents comporte quelque chose comme une proto-réminiscence qui ne soit ni *bouleusis* ni *zèlèsis*. Bien que nous n'en trouvions trace, à ma connaissance, nulle part, il n'est pas interdit de se demander si l'un des traits de l'*anamnèsis* humaine ne serait pas transposable aux animaux : le phénomène de co-évocation des souvenirs peut être décrit comme une séquence de mouvements (*kineseis*) s'enchaînant en vertu d'une liaison associative (*De Mem.*, 2, 451b10-16). Peut-être y aurait-il alors chez certains animaux une suite mécanique d'empreintes sensorielles guidées par l'habitude, mais les collections seraient plus hasardeuses que chez les humains car, sans doute, la contiguité temporelle l'emporte-t-elle chez eux sur les liens de ressemblance, d'où ces simili propositions d'empirie de type aberrant pour l'humain, mais dans lesquelles une collection d'empreintes (du rouge, un cri, du rugeux) peut tenir lieu de «sujet» au même titre que Callias, Socrate...

Malgré son caractère éminemment conjectural, cette reconstruction n'en a pas moins, à mon sens, sa cohérence. Elle pousse jusqu'au bout ce fait que participer, même faiblement, à l'expérience et à l'habitude, doit signifier nettement plus que n'y pas participer du tout. Maintenant, est-il possible de reconnaître une telle *phronèsis* dans les conduites animales, plus particulièrement dans l'*H.A.*, IX, livre le plus riche sur ce point? Je dois avouer ici mon embarras et ma seconde partie sera dans une certaine mesure plus négative que la première. J'espère toutefois qu'elle aura pour elle d'être plus certaine.

II. Physikòs

Renversant la démarche proposée précédemment, je me demanderai si le modèle heuristique proposé n'est pas trop global. En effet, s'il peut être satisfaisant pour l'esprit (*eulogos*), rien n'assure qu'il corresponde bien à la démarche aristotélicienne. Plutôt que de chercher à construire

un «idéal-type» utile à l'interprète, n'est-il pas aussi pertinent de prendre acte du fait qu'Aristote ne s'en soit, semble-t-il, pas soucié? Ne nous abuserions pas en parlant de la *phronèsis* animale? Devons-nous supposer qu'il n'existe qu'une seule et même *phronèsis* pour tous les animaux? Autrement dit, la construction d'un tel idéal-type ne revient-elle pas à faire comme si, à l'instar du genre humain, il n'y avait qu'une seule espèce animale? Ne pécherions-nous pas en faisant «entrer n'importe quoi dans n'importe quoi» (*De An.*, I, 3, 407b21-23; II, 2, 414a24-25)?

C'est pourquoi, à l'aide d'un bref détour par l'*E.N.*, VI, 7, 1141a22-33, j'en reviendrai à mes remarques préliminaires sur le vocabulaire aristotélicien. On se souvient que c'est dans ce passage de l'*Éthique* qu'Aristote mentionne que «certaines des bêtes sont dites prudentes parce qu'il apparaît qu'elles possèdent une faculté de prévoyance à propos de leur propre vie». Or, et tel est le sens de ce passage controversé²¹, si l'on peut qualifier certaines bêtes de prudentes, c'est parce que, à la différence de la *sophia*, la *phronèsis* est variable, relative à des biens eux-mêmes relatifs. En raison de ce caractère, Aristote refuse d'identifier la *sophia* et la politique, car alors elle se confondrait avec la *phronèsis* et, à ce compte, il y aurait une multiplicité de «sagesses théoriques» (ce qui ne doit pas être en raison de la définition de la *sophia* qui porte sur un bien identique pour tous) puisqu'il n'existe pas une sagesse *une* s'appliquant au bien de tous les animaux, mais une sagesse différente pour chacun, cette sagesse étant en fait une *phronèsis* :

«Il est de toute évidence aussi que la sagesse (*sophia*) ne saurait être identifiée à l'art politique : car si on doit appeler la connaissance de ses propres intérêts une sagesse (*ei gar tèn peri ta ôphelima ta aulois erousi sophian*), il y aura une multiplicité de sagesses : il n'existe pas, en effet, une seule sagesse s'appliquant au bien de tous les êtres animés (*peri lo hapantôn agathon tòn zôôn*), mais il y a une sagesse différente pour chaque espèce (*all'hetera peri hekaston*), de même qu'il n'y a pas non plus un seul art médical pour tous les êtres.»

(trad. J. Tricot)

Si donc l'on admet à partir de ce texte que la *phronèsis* concerne la recherche du bien relatif à ses propres intérêts, à sa vie propre — ce qui justifie que l'on puisse parler d'animaux *phronimoi* et que ni Thalès, ni Anaxagore, pour sages qu'ils sont ne puissent être considérés comme

(21) Les lignes 1141a25-27 sont en effet controversées. Je n'entends pas entrer ici dans les détails de cette «polémique», car qu'on maintienne avec les MSS le *aulo*, ce que fait Bywater, suivi en France par Tricot, ou qu'avec Burnet on le supprime, leçon suivie par Gauthier et Jolif, il n'en reste pas moins que la *phronèsis* diffère de la *sophia* en ce qu'elle est variable et relative, ce qui est le point essentiel de l'argument. La première lecture, qui me semble préférable, rapporte cette relativité au bien poursuivi par l'animal lui-même, tandis que la seconde la rapporte à l'éleveur qui sait ce qui est bien pour chaque animal.

prudents — alors il faut en conclure, quelle que soit la leçon ici adoptée, qu'il y a diverses *phroneseis*, chacune étant relative au bien de chaque animal²². Autrement dit, d'un animal à l'autre, la *phronèsis* diffère car la recherche du bien, ou, pour parler plus rigoureusement à propos des animaux, leur faculté de prévoyance en ce qui concerne leur propre vie, ne saurait être toujours la même en raison des différences entre leurs genres de vie. De là sans doute l'utilisation par Aristote de termes différents pour désigner les caractères et comportements différents des divers animaux. De là sans doute aussi l'usage des comparatifs, puisqu'en raison même de leur mode de vie les animaux ont à être plus ou moins intelligents, ces différences de degré pouvant d'ailleurs se retrouver à l'intérieur d'un même genre, ainsi qu'en témoignent la rusée seiche et l'inintelligent poulpe.

On peut soutenir et amplifier ce point en partant de ce qu'Aristote appelle les actes (*praxeis*) relatifs à la vie des animaux. En effet, si les premiers chapitres de l'*H.A.*, I, présentent de nombreuses différences (*diaphoras*) relatives aux modes de vie des animaux, l'*H.A.*, VIII, 1, se conclut en soutenant que leur vie et leurs efforts (*ai spoudai*) se concentrent chez tous dans les actes qu'ils accomplissent en vue de se reproduire et de se nourrir (589a2-5). Aristote sera encore plus clair lorsque dans l'*H.A.*, VIII, 12, 596b20-23, il précisera que cette bipartition est en fait une tripartition :

«Quant aux actes qu'ils accomplissent, ils se rapportent tous à leur accouplement, aux soins à donner aux petits, à la recherche de la nourriture, et ils leur sont suggérés d'après la succession du froid et du chaud et au rythme des changements de saison.»

(22) On pourrait éventuellement m'objecter que ce passage de l'*E.N.* porte sur la *sophia* et non sur la *phronèsis*, par conséquent on ne pourrait rien en conclure sur les *phroneseis* animales. Je ne crois pas cette objection recevable car, s'il est bien vrai que ce chapitre traite de la *sophia*, il s'efforce de la distinguer de la *phronèsis*, et tel est le sens du passage sur lequel je m'appuie. L'argument (cf. *supra* n. 21) consiste à soutenir que la *phronèsis* diffère de la *sophia* en ce qu'elle est variable et relative, dès lors on ne saurait user du terme *sophia* pour désigner un savoir variable et relatif sans se contredire, ce que font ceux qui nomment *sophia* l'art politique. En effet, ce dernier en tant qu'il relève de la connaissance de ses propres intérêts, est variable et doit être proprement nommé *phronèsis* (de là d'ailleurs que ce terme puisse également être appliqué à la connaissance qu'ont les animaux de leurs propres intérêts), or, si l'on nomme improprement cette connaissance *sophia*, alors il y aura une multiplicité de *sophiai*, ce qui ne peut et doit être en raison de l'unicité de la vraie *sophia*. On le voit donc, ce texte sert fort bien mon argument relatif à la multiplicité des *phroneseis*, puisque ce que Aristote veut dire en disant qu'il n'y a pas une seule *sophia* s'appliquant au bien de tous les animaux mais une différente pour chaque espèce, c'est que cette *sophia*-là n'en est pas une, sauf à parler improprement, mais est, par définition, une *phronèsis*. Notons encore que sur la variabilité et sur la relativité, on trouvera un argument du même type à propos du plaisir dans l'*E.N.*, X, 5, 1176a3-9.

En laissant ici de côté les considérations relatives au climat²³, il me semble que c'est à partir de ces trois types d'«actes vitaux» (reproduction, élevage, nourriture) que l'on peut comprendre en quoi les animaux sont *phronimoi*. Quand bien même en effet la *phronèsis* animale renvoie à cette *dynamis pronoëtikè* relative à la recherche du bien pour sa propre vie, elle ne saurait être identique chez tous les animaux puisque tous n'accomplissent pas de la même façon leurs trois types d'actes vitaux.

Peut-être est-il donc préférable de repérer, à l'intérieur de chaque espèce animale, comment se manifeste, dans l'accomplissement des trois types d'actes vitaux, des actes dus à la *phronèsis*. Si cette *phronèsis* renvoie à un certain type de recherche du bien participant quelque peu à l'expérience et à l'habitude, le tout pouvant être renforcé par l'éducation, il n'en reste pas moins que c'est de façon différente que les divers animaux seront dits *phronimoi*. Non seulement ils accomplissent différemment leurs actes vitaux, mais encore ils ne sont pas également intelligents dans ces trois types d'actes. De là vient sans doute que ce que l'on peut indifféremment nommer *phronèsis* ou *synesis* soit souvent désigné à l'aide d'autres termes spécifiant plutôt les qualités propres à tel ou tel animal. Les oiseaux seront ainsi volontiers qualifiés d'*eumèchanoi* et d'*eubiotoi*, qualités qui semblent communes à tous (*H.A.*, IX, 16, 616b13-14)²⁴, parce que leur «ingéniosité» dans la construction du nid ou dans la recherche de la nourriture leur permet de «bien-vivre». D'un autre côté, l'intelligence des insectes sera qualifiée d'*ergatikè* parce qu'elle est principalement ordonnée autour du minutieux «travail» qu'ils accomplissent, souvent «en commun» comme chez les abeilles et les fourmis, ce qui les rend de surcroît *politika* (*H.A.*, I, 1, 488a7-10) sans que ce soit pour autant des animaux aux sentiments et comportements familiaux développés, ce qui est le cas des quadrupèdes (qu'ils soient grégaires ou solitaires) et, dans une moindre mesure, de beaucoup d'oiseaux. Ajoutons encore que de nombreux poissons sont qualifiés de *technika* parce qu'ils déploient de véritables ruses pour chasser, pour se défendre, ou bien encore pour se libérer de l'hameçon.

Je voudrais maintenant, à l'aide de quelques exemples, développer certains de ces points afin de caractériser un peu plus le type d'intelligence pratique à l'œuvre chez divers animaux quand ils

(23) Il faudrait d'ailleurs y ajouter les considérations relatives aux lieux (*chōrai*, *H.A.*, V, 11, 543b23-31 ; *kata tous topous*, VIII, 28-29). Ces diverses considérations sont destinées à montrer que non seulement les animaux, mais plus encore leurs comportements diffèrent selon les climats et les sols.

(24) Il semble cependant y avoir quelques exceptions : certains oiseaux sont dits *amèchanôteroi* (614b34) sans que Aristote précise plus. Peut-être s'agit-il du chardonneret (*akanthis*) *kakobios* (616b31), ou bien encore de «l'aigle aux ailes tachetées de noir» (*perknopteros*, 618b31-619a3).

accomplissent leurs actes vitaux. *A priori*, l'acte vital dans lequel se manifeste le moins cette intelligence est celui de la reproduction (j'entends ce terme au sens strict et désigne par là l'accouplement et la copulation). Aristote, sauf erreur de ma part, ne mentionne jamais un acte de *phronèsis* à ce propos. C'est tout à fait normal si l'on se souvient qu'en *G.A.*, I, 23, 731a24-b8, il soutient que l'acte même de se reproduire est un acte de l'âme végétative (*lo phylikon*) et est donc une fonction commune à tous les vivants. Il n'hésite d'ailleurs pas à écrire que l'animal, lorsqu'il s'accouple, « devient comme une plante (*ginelai hôsperanei phylon*) ». La seule différence d'avec les plantes est qu'étant donné que les animaux sont doués d'*aisthêsis*, il s'y ajoute du plaisir (*hêdonê*, *H.A.*, VIII, 1, 588b24-30). Or ce plaisir est tel qu'il conduirait plutôt à l'*hybris* qu'à la *phronèsis*, ainsi qu'en témoigne la fureur lubrique qui saisit les animaux au moment du rut (*H.A.*, VI, 18).

Cependant, si l'on rapporte cet acte à sa conséquence, la mise au monde de *lekna*, alors, avant même qu'il ne soit à proprement parler question d'élevage, les choses prennent un tour quelque peu différent. L'exemple le plus probant en est sans doute la différence entre ces deux genres d'ovipares que sont le genre des poissons et celui des oiseaux. Sans qu'il soit ici nécessaire de prendre en considération les faits relatifs à la plus ou moins grande fécondité des oiseaux (*G.A.*, III, 1, 749a34-750b1), remarquons que la reproduction des poissons ovipares, à l'exception sans doute de la silure (*glanis*, *H.A.*, VI, 14, 569a4; IX, 37, 621a20-b2), ajoute à l'imperfection de ce mode de reproduction, celle particulière aux poissons (leurs œufs sont inachevés, *G.A.*, II, 1, 732b2-7; 733a17-32; 733b7-10) mais aussi celle de la chance. En effet, si ces animaux sont très prolifiques, c'est parce que nombre de leurs œufs déjà pondus un peu n'importe comment par les femelles sont de plus détruits ou dévorés par les mâles en même temps qu'ils les fécondent en les arrosant de leur lait (*H.A.*, VI, 13; *G.A.*, III, 4-5). Et je ne parle même pas ici du sort souvent tragique des jeunes alevins dévorés par de plus gros qu'eux, quoique souvent ils doivent leur survie à cette petitesse : ils sont dédaignés par les grands poissons (*H.A.*, VIII, 19, 602b2-5). Heureusement dès lors que la nature, faisant toujours de son mieux avec ce dont elle dispose²⁵, compense en quantité ce qu'elle ne peut donner en qualité (*G.A.*, III, 4, 755a11-35). Nul doute qu'un tel phénomène soit à rapporter au fait que les poissons ovipares n'élèvent pas leurs petits mais les laissent grandir, ce qui heureusement, la nature faisant encore une fois de son mieux, se déroule très rapidement (*H.A.*, V, 10, 543a29-31; *G.A.*, III, 4, 755a11-14).

En revanche, les oiseaux, ayant à élever jusqu'à un certain point

(25) Le finalisme artistotélicien n'a en effet pas grand chose à voir avec une providence omnipotente, cf. *P.A.*, II, 14, 658a23-24; IV, 10, 687a15...

leurs petits, ne pondent pas « à l'aveuglette » et manifestent à cette occasion de la « prudence ». En témoigne même le contre-exemple du coucou (*kokkux*) qui, en raison de sa légendaire lâcheté (*deilia*), agit prudemment (*phronimon*) en déposant ses œufs dans le nid des autres (*H.A.*, VI, 7, 563b29-564a3; IX, 29, 618a25-30). On pourrait en dire de même de la pigeonne (*hê perislera*) qui, en cas de danger, peut s'empêcher de pondre et retenir son œuf (*H.A.*, VI, 2, 560b21-25). Mais le cas le plus probant est sans doute celui des perdrix (*perdix*) ou des cailles (*orlux*) auxquelles Aristote consacre un long chapitre (*H.A.*, IX, 8). Voilà des animaux lubriques²⁶, méchants et rusés (*kakoêthes kai panourgon*, 613b23) et pourtant les femelles déploient une grande ingéniosité pour pondre et couvrir leurs œufs : oiseaux au vol pesant et ne faisant en conséquence pas de nid (613b6-12), elles ne pondent pas toujours au même endroit afin que leurs œufs ne soient découverts ni par les chasseurs, ni par les mâles toujours prêts à briser les œufs afin de côcher à nouveau (613b15-21, 25-27). Elles s'ingénient à trouver des parades contre ces ennemis, ce qu'Aristote souligne en qualifiant la femelle d'*anlimèchanômenê*. Ainsi par exemple, si pressées de pondre elles ne peuvent plus se retenir, elles pondent un peu n'importe où, puis elles s'empressent de s'éloigner de leurs œufs et vont parader devant les mâles ou les chasseurs afin qu'ils ne trouvent pas les œufs. Elle agit de même avec sa « nichée ». Nous avons donc bien là quelque chose comme un raisonnement relevant de la ruse et de la « machination », ici fort poussée ainsi qu'en témoigne le terme *anlimèchanômenê*, phénomène étranger à la ponte des œufs chez les poissons quand bien même ces derniers pondent dans des lieux propices (*H.A.*, VI, 13, 567b11-18). Il va de soi, ainsi que je l'ai déjà mentionné à propos de la biche, que ce phénomène s'accroît dès lors que nous avons affaire à des vivipares. Citons en ce sens les femelles des bisons (*bosanos*) qui se regroupent dans les montagnes afin de mettre bas, non sans avoir auparavant construit autour d'elles une sorte de rempart (*peribolon*) à l'aide de leurs excréments (*H.A.*, IX, 45, 630b14-16)²⁷.

Les deux autres types d'actes vitaux, l'élevage plus ou moins long des petits et la recherche de la nourriture, sont bien entendu ceux dans

(26) C'est un point sur lequel Aristote revient souvent : *H.A.*, I, 1, 488a4; VI, 9, 564a11-12; *G.A.*, II, 7, 746b1; III, 1, 751a20...

(27) Les bisons ont la réputation de lâcher beaucoup d'excréments. Le font-ils simplement sous l'empire de la peur comme beaucoup d'animaux (*P.A.*, II, 4, 650b30-33) ou bien, telle la seiche, le font-ils « intelligemment » ? Outre que les bisons ont sans doute un sang de la même nature que celui des taureaux et des sangliers, et sont donc plutôt impétueux que craintifs, la deuxième solution semble préférable, car Aristote précise qu'ils s'en servent comme d'une défense (*P.A.*, III, 2, 663a13-17) et que lorsqu'ils les projettent pour se défendre, ils ont alors la particularité de brûler, ce qui n'est pas lorsqu'ils se satisfont tout bonnement (*H.A.*, IX, 45, 630b7-13).

lesquels les animaux manifestent le plus leur «intelligence pratique». Ici plus encore qu'ailleurs il y a lieu de parler plutôt de *phroneseis*. Par exemple, le mode de reproduction des insectes est considéré par Aristote comme le plus imparfait qui soit (*G.A.*, II, 1), ce qui devrait conduire d'après *G.A.*, III, 2, 753a7-17, à les considérer comme peu intelligents s'il est vrai que l'intelligence croît avec la plus ou moins longue attention portée aux petits. Or, nous savons bien qu'il n'en est rien et que l'abeille ainsi que d'autres animaux de ce genre est considérée comme plus intelligente que nombre d'autres animaux²⁸. Hé bien! Que cette intelligence soit systématiquement qualifiée d'*ergatikè*, de «laborieuse», dans l'*H.A.*, IX, 38-40, me semble justement prendre en considération ce fait : quand bien même l'abeille, genre extraordinaire et divin (*G.A.*, III, 10, 760a4-6, 761a5), montre la savante organisation de la nature dans sa reproduction, elle n'est pas pour autant qualifiée d'intelligente eu égard aux «soins» qu'elle prodigue aux larves, mais eu égard à l'œuvre qu'elle accomplit dans une ruche organisée par la division du travail (*H.A.*, IX, 40, 625b18-27). Son intelligence «laborieuse» et «épargnante» (623b17-18, 627a19-20; l'abeille partage cette qualité avec la fourmi, 622b26) n'est donc pas de même nature que celle des sanguins et des vivipares.

Autrement dit, les animaux peuvent manifester de l'intelligence dans un domaine et pas dans un autre. Il reste cependant vrai que ces traits d'intelligence ont, d'une façon ou d'une autre, toujours affaire à leur *sôlèria*, mais ils renvoient à l'assomption intelligente et non pas seulement mécanique de cette tâche. C'est sans doute pourquoi Aristote étudie si longuement les oiseaux, bien qu'à suivre le jeu des comparatifs ils soient censés être moins intelligents que les vivipares. S'ils sont qualifiés d'*eumèchanoi* et d'*eubioloï* c'est parce qu'ils assument la tâche de se conserver avec ingéniosité, ce qui rend leur vie sinon «bonne» du moins aisée à vivre. Aussi bien dans la façon de construire leur nid, d'élever leurs petits en les accoutumant progressivement à leur future vie d'adultes, voire de se procurer leur nourriture (tâche plus aisée pour les non carnivores, *G.A.*, III, 1, 749b24-25), on les voit déployer un art fondé sur une certaine expérience et sur une certaine habitude acquises par l'enseignement (*H.A.*, IX, 7, 612b21-31, pour l'hirondelle, *chelidôn*). Quel que soit le type d'aliments dont se nourrissent les oiseaux, Aristote soutient qu'ils ont un «raisonnement sûr» (*ten tès dianoias akribeian*, 612b20-21) parce qu'ils agissent *technikôs* (IX, 13, 616a4) et sont par là *eumèchanoi*, qualificatif portant aussi bien sur la façon de construire le nid, de protéger et d'élever les petits, que sur celle de se procurer de la

(28) Bien qu'extraordinaire, le mode de reproduction des abeilles est imparfait. Comme celui de tous les autres insectes, il n'entraîne pas d'élevage à proprement parler. Aristote note cependant que les ouvrières prennent soin des petits (*G.A.*, III, 10, 759a36, b6-7), c'est-à-dire qu'elles veillent au bon développement des larves.

nourriture et de «sauver sa peau». En voici un nouvel exemple tout à fait remarquable :

«On dit aussi que les pigeons reconnaissent (*ginôskein*) chacune des variétés de faucons (*hierax*), au point qu'au moment où les faucons fondent sur eux, s'il s'agit de ceux qui attrapent leur proie au vol, ils restent là où ils sont posés, et qu'au contraire, si l'attaquant est un de ceux qui foncent sur le sol, ils ne l'attendent pas et s'envolent.» (*H.A.*, IX, 36, 620a29-33).

Outre qu'une telle pratique demande un réel «sang-froid», elle implique surtout quelque chose comme un raisonnement en forme de *si...alors*, raisonnement impliquant en amont que les pigeons soient capables de «classer» les faucons, et donc qu'ils soient à même de reconnaître le genre faucon parmi les oiseaux à serres recourbées (*la ganpsônucha*) puis d'y discerner ses diverses espèces.

Il me semble donc que la question de la *phronèsis* animale gagne beaucoup si l'on cherche à en spécifier ses aspects relativement au «bien» de chaque animal. Il n'en reste pas moins que les choses ne deviennent pas absolument claires pour autant. Ainsi, s'il est permis de se demander si ce ne serait pas en raison de l'art que les oiseaux à serres recourbées ont à développer pour se procurer leur nourriture, qu'ils sont bien moins doués de l'intelligence grégaire, voire familiale²⁹, la même conséquence ne semble plus valable pour des vivipares carnivores tels lions ou dauphins (*H.A.*, IX, 44 et 48). Remarquons à ce sujet que l'intelligence des vivipares, les plus parfaits des animaux du point de vue de leur reproduction, n'est pas traitée de façon toujours satisfaisante par Aristote. D'une part l'épaisseur du sang de certains vivipares les rend moins intelligents que d'autres vivipares au sang léger ou que d'autres animaux dotés d'un analogue de sang léger, mais d'autre part la plus grande intelligence de certains les rend plus «familiaux», seraient-ils sauvages et solitaires. Or le rapprochement entre *H.A.*, VIII, 1, 589a1-2, où les plus intelligents sont dits «plus politiques» parce qu'ils vivent plus longtemps avec leurs petits, et *G.A.*, III, 2, 753a7-17 qui emploie le même argument en soutenant que ces animaux ce sont les hommes et certains quadrupèdes, sans toutefois les qualifier de «politiques», invite à se demander s'il n'y aurait pas un sens politico-familial de la *phronèsis* ou *synesis*, sens caractérisant plutôt les quadrupèdes et certains vivipares, mais sens apparemment mal maîtrisé par Aristote lui-même. Toujours est-il que c'est ce sens là qui semble surtout intéresser Aristote lorsqu'il parle des quadrupèdes. J'en veux pour preuve le respect qu'a l'éléphant pour sa femelle une fois qu'il l'a rendue grosse (*H.A.*, V, 14, 546b10; IX, 46, 630b21-22), ou bien le refus des jeunes chameaux de

(29) Aucun oiseau à serres recourbées n'est grégaire (*H.A.*, I, I, 488a5) et de plus les aigles ne passent généralement pas pour des parents très attentionnés (*H.A.*, VI, 6; IX, 32, 619a27-31; 34, 619b27-34).

monter leurs mères (H.A., IX, 47, 630b31-631a.1), ou bien encore l'extrême sollicitude des dauphins à l'égard de leur progéniture (H.A., IX, 48).

Ma conclusion sera donc aussi simple que brève. Si nous ne pouvons échapper à cette question : qu'est-ce que la *phronèsis* animale? et la traiter d'abord en nous demandant quel type de connaissance elle implique, il semble qu'il ne faille pas s'abuser par la légitime question de l'interprète. En effet, en suivant la démarche aristotélicienne de plus près, nous sommes conduits, semble-t-il, à substituer au problème de la *phronèsis* celui des *phroneseis*. Cette approche, qui ne peut faire l'économie de la première, montre que par *phronèsis* ou *synesis* Aristote n'entend pas nécessairement des qualités indifférenciées, et qu'au contraire il s'attache plutôt à spécifier différents types d'intelligences animales à l'œuvre dans les façons différentes d'accomplir les actes vitaux relatifs au bien propre de chaque animal.

SUBSTANCES AND SPACE-TIME: WHAT ARISTOTLE WOULD HAVE SAID TO EINSTEIN

TIM MAUDLIN

Like Empedocles' βουγενῇ ἀνδρόπρωρα, this essay will doubtless appear to be an ungainly, if not monstrous, concatenation of diverse topics. To conjoin exegesis of Aristotle's *Metaphysics* with an examination of the general theory of relativity must seem an act both ahistorical and philosophically perverse. And indeed, the marriage of these subjects is not an entirely happy one. The detail required for a satisfactory presentation of the textual analysis surpasses the needs of the later discussion of space-time, and so compromises the unity of the whole. Still, the advantages afforded by this peculiar conjunction outweigh the drawbacks, for it illustrates the relevance of longstanding philosophical analyses to modern problems, problems which often present themselves in a gaudy technical garb. Although Aristotle had no notion of anything like modern physics, some of the puzzles he grappled with are exactly those which we face in trying to interpret our scientific theories. I hope to show that some of the recent debates concerning the status of space-time in general relativity afford a case in point.

Aristotle's *Metaphysics* is a tract concerned with being, and the central books focus on those entities which most unqualifiedly partake in being: substances. Book Z, in particular, is devoted to the articulation of criteria by which to distinguish substances from non-substances; to the identification of substances; and to examinations both of the relationship between substances and their properties and of that between form and matter. This last topic is particularly pressing for Aristotle, for having supplemented the doctrine of the *Categories* with a hylomorphic analysis of substance he must now determine whether and

how form and matter can combine to produce a truly unified substance. He finds that assimilating the relationship of matter and form to that of substance and accident has disastrous consequences, so he must struggle to find a new model for their inter-relationship. The first section of this essay examines one of the central passages in the treatment of matter and form, the famous "stripping" argument of Z. 3. I shall contend that this passage contains a premise, commonly overlooked in discussions, which identifies the argument as non-Aristotelean and whose denial provides Aristotle with a means of avoiding some absurd consequences. In order to explain why this premise is unacceptable, he must introduce the notions of *ἐνεργεια* (actuality) and *δύναμις* (potentiality), using them to explicate the connection between form and matter. Form and matter are indeed, on Aristotle's account, much more intimately related than are substance and accident. This moral shall be employed in the analysis of the ontological status of space-time in the later sections of the paper.

The notion of substance has played a leading role in the ongoing debate about the nature of space and time. Although neither Isaac Newton nor Samuel Clarke claimed that space is a substance, the positions taken in the famous debate between Leibniz and Clarke have come to be known, respectively, as relationism and substantivalism. Various philosophical views asserting and denying that space and time are real entities distinct from physical objects have been refined, and the pendulum swings between them have often been guided by technical results of current physical theory. One such argument has recently been presented by John Earman and John Norton, who maintain that a substantivalist must be willing to accept a radical indeterminacy in physical law as the price for that ontology.¹ The second part of this paper will examine their argument and the strictures on substances that underlie it. I shall argue that the moral found in Aristotle has application here, since an Aristotelean account of the relationship between space-time points and their properties may provide the substantivalist an escape from Earman and Norton's dilemma. I shall also argue that the structure of the mathematical entities used to represent space-time naturally suggests a misleading analysis of the ontology of space-time itself, which analysis underpins the *prima facie* indeterminism in the substantival interpretation of the General Theory of Relativity. But let us begin with our passage from the Philosopher.

(1) The arguments are presented in Earman ms., Norton 1987, and Earman and Norton ms.

PART 1: THE Z. 3 PUZZLE²

In *Metaphysics* Z. 3 Aristotle begins his investigation into substance. Four candidates for "the substance of each thing" are put forward: the essence, the universal, the genus, and the subject, the last of which is the topic of Z. 3 (1028b34-36). The subject (*τὸ ὑποκείμενον*, literally "what underlies") is identified as that of which everything else is predicated, and which is itself predicated of nothing else. This characterization immediately rules out all entities from the categories other than substance from being the ultimate (*πρῶτον*) subject since qualities, quantities, places, etc. are always qualities, quantities and places of something. Yet an individual such as Socrates, of whom qualities such as musicality may be predicated, and who would be a paradigm substance in the analysis Aristotle gives in the *Categories*, can also be analyzed into form and matter, and so it is not yet clear whether the ultimate subject is the form, the matter, or the compound of the two (1029a2-9). We must therefore examine which of these has the best claim to be that of which everything else is predicated. At 1029a7-30 Aristotle presents one way of understanding what a subject is, a way which entails that the identification of substance with the ultimate subject must be mistaken. The argument runs:³

So it has now been stated in outline what substance is, *viz.*, it is that which is not said of a subject but everything else is said of it. Yet we must not only define it thus, for this is not sufficient: it is unclear, and moreover matter becomes substance. For if it is not substance, whatever else might be escapes us; for since everything else has been stripped off nothing seems to remain. For all the other things are, on the one hand, affections and products and powers of bodies, and again the length and breadth and depth are sorts of quantities and not substances (for quantity is not a substance); but, rather, that to which these ultimately belong, *that* is substance. But since length and breadth and depth have been stripped off, we don't see anything left unless that which is bounded [or defined] by these is something, so that matter alone must seem to be substance to those who investigate it in this way. I mean by "matter" that which in itself is said to be neither something (*τι*)⁴ nor so-much nor any of the other things by

(2) I am indebted for very useful comments on the section to Rob Bolton and especially to Mary Louise Gill, whose influence permeates the whole.

(3) All translations are my own, from the text of Jaeger. I have aspired to literalness rather than elegance and have tried to maintain consistent translations of the central technical terms.

(4) The translation of the term "*τι*" throughout this passage cannot but be tendentious. Aristotle says that according to this argument "*τι*" cannot be predicated of the ultimate subject, but then goes on to use that term in referring to it. This might

which being is defined. For there is something of which each of these is predicated, something ($\tau\iota$) whose being is distinct from the being of the things predicated ($\phi\tau\acute{o}\ \epsilon\acute{\iota}\nu\alpha\iota\ \epsilon\acute{\iota}\tau\epsilon\rho\omicron\nu\ \kappa\alpha\iota\ \tau\acute{\omega}\nu\ \kappa\alpha\tau\epsilon\gamma\omicron\rho\iota\acute{\omega}\nu\ \epsilon\kappa\acute{\alpha}\sigma\tau\eta$). For all the other things [than substance] are predicated of substance, and this itself is predicated of matter, so that the final [subject] in itself is neither something ($\tau\iota$) nor so-much nor anything else at all. Nor is it even the negations of these, for they too will belong to it accidentally. It follows for those considering it by these arguments that matter is substance, yet this is impossible. For separability and "thisness" are taken to belong most of all to substance, wherefore the form and the compound of both would seem to be substance rather than matter.

On the face of it, this passage presents a *reductio ad absurdum* of the definition of substance as that of which everything is predicated while it is predicated of nothing else. For the definition seems to pick out as substance some sort of matter which of itself is entirely characterless, indefinite and amorphous; but substances are pre-eminently individual things (cf. 1028a11-20). But, as with every *aporia* which Aristotle presents, we must try to determine how much of the argument is in *propria persona*, whether Aristotle is committed to each of the premises, and whether there is any escape from the conclusion. In this instance such an inquiry is especially urgent, for if the argument is in *propria persona*, not only will it show that Aristotle believed the ultimate subject of predication not to be substance, it will also indicate that he regarded that ultimate subject as entirely characterless. That is, this passage might seem to prove Aristotle to be committed to the doctrine of prime matter.⁵

I do not mean to canvass the arguments for and against prime matter here, but a few remarks on the significance of this passage are in order. The argumentation of this passage arrives at prime matter in a way quite distinct from the other texts which are sometimes taken to establish that doctrine (passages such as *de Gen. et Cor.* 329a24-35 and 332a34-b1). Those arguments, which deal with the conditions necessa-

suggest that the term is being used ambiguously; Robert Bolton has suggested to me that whereas here it means "a particular thing", later it just means "something" (albeit not an member of any of the categories). This interpretation can remove some self-contradictoriness from the passage, but to so *translate* it would hide the (at least) surface paradoxicality of the view. I choose to translate in uniformly as "something" because I believe that paradoxicality to be intended. An exactly parallel, and evidently intentional, rhetorical flourish is used by Plato in a text which I believe to be one of the sources of this argument: *Theaetetus* 202a4. More on that passage anon.

(5) Whether the passage is in Aristotle's own voice is already a matter of some debate. W. Charleton, for example, takes the main line of argument to be that of certain opponents of Aristotle who are identified in *Physics* II (Aristotle 1970, p. 138). H. M. Robinson, in contrast, states that he finds no plausible grounds for supposing a change in voice (Robinson 1974, p. 184). Much of this part of the essay will be devoted to defending the view that the argument is not Aristotle's.

ry for the elements to change into one another, depend crucially on certain *empirical* observations. Were the elements not to be mutable, there would be no question about what, if anything, remains throughout that transformation. Our passage, however, is *metaphysical* or *logical* rather than *empirical* or *physical*. It depends not upon any observed physical behavior of substances but only on the nature of predication. Thus, although the entire issue of prime matter would not be resolved should this argument not be in *propria persona*, still one distinct approach to that doctrine would be blocked, and the relevant evidence would be confined to the analysis of the transmutation of elements.

I shall maintain that the argument of Z. 3 is not Aristotle's own, that he is not committed by it to the doctrine of prime matter, and that it employs what is for Aristotle a mistaken account of the relationship between form and matter in a compound substance. I shall begin by presenting some circumstantial clues that suggest this reading. But the major burden of this part shall be an exposition and analysis of the premises employed in the argument. Among these we shall find one that runs counter to the ensuing discussions in the *Metaphysics*, which allows us to see just why Aristotle need not accept the conclusion of Z. 3. Finally, I shall suggest a possible source for the Z. 3 puzzle. But let us begin with some superficial evidence.

There are clear indications in this passage that Aristotle was following out a line of thought already extant in the philosophical literature. He notes that various things follow "for those who investigate it in this way" (1029a19, cf. also $\epsilon\kappa\ \mu\epsilon\acute{\nu}\ \omicron\upsilon\acute{\nu}\ \tau\omicron\upsilon\tau\omega\acute{\nu}\ \theta\epsilon\omega\rho\omicron\upsilon\sigma\iota$ at a26). This may only refer to who accept that the ultimate subject is substance, but it may also indicate that other peculiar premisses are used in the deduction. The conclusion of the passage seems stronger than the announced intention and also conflicts with Aristotle's later pronouncements. For although he begins by suggesting that the characterization of substance as subject is obscure and in need of clarification, he seems to end by rejecting it altogether since it implies that a totally indeterminate matter is substance. Yet the synopsis and review of Z which begins chapter H still recognizes the subject as substance (1042a13) and identifies this underlying substance as matter (1042b9). So either Aristotle has simply forgotten the result of Z. 3 or he feels that those objections to the subject-criterion of substance have been overcome. Let us take the latter possibility as a working hypothesis and seek a premise of the Z. 3 argument which may have come to be rejected.

If the foremost point of the Z. 3 passage is to identify the ultimate subject of predication, one line alone seems sufficient to solve that problem: "For all the other things are predicated of substance, and this

itself is predicated of matter" (1029a23). Aristotle nowhere denies this assertion, and it corresponds with the identification of substance-qua-subject with matter in H. 1 and H. 2. But it is not simply the result that matter becomes substance which generates the difficulties of Z. 3, but that the matter should be so entirely characterless, possessing none of the usual marks of substance. This reduction of matter to the totally indefinite does not follow simply from the claim that all things are predicated of substance and it of matter. Abstraction of all the predicates from the subject is involved, this being the stripping process so central to the text. What is involved in this abstraction? What conditions must hold for the separation of predicate and subject to be possible?

The stripping process of Z. 3 is a matter of logical abstraction, of disregarding properties. Just as we construct a proof about triangle *qua* triangle not by considering a triangle which is neither scalene nor isosceles but by allowing the proof only to employ those features mentioned in the definition of a triangle, so too can we more generally disregard the inessential features of an object. We do not abstract color, say, from Socrates by imagining him to have no color, or by considering processes for removing all color from him, but by recognizing that the characterization of Socrates *qua* human being need not advert to his color.⁶ If the stripping process is such a disregarding of properties, then the success of the procedure critically depends upon one condition: *the predicate disregarded cannot be part of the defining conditions of the subject of which it is predicated*. The essence of the predicate and that of the subject must be logically distinct, else the result of disregarding the predicate will not be to leave one with the subject as such.

The logical independence of the predicate and subject, then, is an essential premise of the Z. 3 analysis. Further, it is not employed by Aristotle as a tacit background assumption, but is quite explicitly stated: "For there is something ($\tau\iota$) of which each of these is predicated, *something whose being is distinct from the being of the things predicated*" (1029a21-23). Indeed, this premise in conjunction with the assertion that "all the other things are predicated of substance, and this itself is predicated of matter" immediately yields the conclusion that matter

(6) Russell Dancy, in [Dancy 1978], assimilates the abstracting process to one of *imagining the property physically removed from the substance*, thus obscuring the vital difference between this logical argument and the empirical arguments concerning substantial change. Dancy suggests, for example, that we "strip off" a statue's color using turpentine (p. 398). Such appeal to physical procedures is clearly too weak for Aristotle's purpose: how could one strip off color generally, or be assured of an actual process which would eliminate all of the particular affections, products, and powers of bodies?

cannot be substance. For whatever characteristics make something a substance are predicated of matter, which in itself must have a distinct, and hence non-substantial, essence. So our quarry is nearly cornered: we now have a simple two-premise argument whose conclusion conflicts with Aristotle's retention of matter or the subject as a sort of substance in book H. If he is to be consistent he must either reject that substance is predicated of matter or that subject and predicate always have logically distinct beings.

The distinctness of the being of the predicate from the being of the subject is *prima facie* a very questionable premise. After all, one would suppose that anything of which substance is predicated thereby *is* a substance, rather than the opposite. And, to take a mundane example, although we all agree that there is something of which the hardness, rectangularity, color, etc., of the table are predicated, we would balk at the suggestion that the subject is something entirely distinct from these properties. After all, it is the *table* which is colored, hard, rectangular, etc., and we have no reason to believe that the table could be defined (or could exist) independently of these qualities. The distinctness thesis immediately implies that *nothing* can be affirmed of the ultimate subject of predication as such ($\chi\alpha\theta' \alpha\upsilon\tau\acute{o}$), for to do so would be to predicate something of it. Indeed, despite his sanguine locutions early in the passage, Aristotle is forced to forgo calling the ultimate matter even *something* ($\tau\iota$) (1029a20).

As the reader will doubtless have anticipated, it is the premise which asserts the universal distinctness of the being of the subject from that of the predicate which I believe not to be accepted by Aristotle. If he has imported this premise from elsewhere, we should expect him to develop an account of predication which denies it. And should this premise fall, with it would fall both the general argument for prime matter in Z. 3 and the objections to the characterization of substance as the ultimate subject of predication.

My evidence for this reading of Z. 3 will be of three types. First is a text which directly indicates that Aristotle rejected the Z. 3 picture of predication. Next we shall examine *Metaphysics* Z and H to see whether Aristotle's considered views allow him to avoid the aporia. Finally, a possible non-Aristotelean source for the Z. 3 argument will be suggested.

The stripping procedure of Z. 3 does not immediately strike one as non-Aristotelean because the process of abstraction is one Aristotle often uses. One commonly can disregard various predicates of a subject, and must do so to properly understand *qua* what the subject has certain of its properties. And the stripping process clearly *is* legitimate when the being of the subject and the predicate are distinct. But this holds just when the predicate is an *accident* of the subject, rather than

part of its *essence*. The Z. 3 thesis, then, is that *every* predicate is an accident of its ultimate subject, prime matter, and hence can be logically stripped from it. But Aristotle denies this very thesis in *Metaphysics* Γ. 4:

And those who say this generally destroy the substance and the essence. For it is necessary for them to say that everything is accidental... To indicate the essence [of something] is to say that its being (τὸ εἶναι αὐτοῦ) is nothing else... So that it is necessary for them to say that there will not be such an account [i.e. of the essence] of anything, but all attributes are accidental. For substance and accident are distinguished by this: the white is accidental to the man because although he is white, white is not in his essence.⁷ But if everything is predicated accidentally, there will not be any ultimate thing of which they are predicated, if the accident always indicates a predicate of some subject. For it [i.e. the identification of new subjects] must go on *ad infinitum*, but this is impossible (1007a20-b1).

The argument refuted in this passage bears a strong resemblance to that of Z. 3. Someone has taken a position which implies that the predicate is always accidentally predicated of the subject, that it is never part of the essence of the subject, so that the beings of the predicate and of the subject are always distinct. But then the being of the subject itself must be predicated of yet another distinct subject, and so on indefinitely. The Z. 3 passage bites off the regress by positing an ultimate subject which *has* no essence, nothing true of it as such. But Aristotle would surely conclude that the Z. 3 argument, as much as this, destroys the substance and the essence since according to it nothing is ever essentially predicated of a subject. If Aristotle here rejects the notion that all predication is accidental, it is difficult to imagine that he would accept in Z. 3 that the ultimate subject of predication is prime matter, all of whose positive attributes at a time are accidents.

If, then, the Z. 3 argument is not in Aristotle's own voice, and if the unacceptable premise is not the identification of substance with the ultimate subject but rather the thesis that the being of the predicate and that of the subject are always logically distinct, then we should expect Aristotle to develop an account of the relationship between substantial form and the matter of which it is predicated which contradicts that thesis. This is just what he does.

Let us begin by considering the most clear and, *prima facie*, undeniable example of a substance: a living animal. An animal, such as a human being, has a form: its soul. That soul is predicated of a certain particular kind of matter: an organic body (cf. *de Anima* 412a28,

(7) The phrase here, οὐχ ὅπερ λευκόν, does not explicitly mention the essence, but is best rendered as saying that white is not in the essence of man. Cf. Jonathan Barnes commentary in his translation of the *Posterior Analytics* (Aristotle 1975) p. 168.

Metaphysics 1037a5 ff., 1041b6). The immediate matter of a human is a complete body composed of non-uniform parts such as the face, hand, heart, etc. The matter of these in turn are the organic uniform parts such as blood and bone.⁸ What is the logical relationship between the being of the form and the being of the matter in this case?

Aristotle is quite clear and emphatic on this point. The non-uniform parts, and even their uniform constituents, only are what they are when ensouled. A dead hand is a hand in name only, like the stone hand of a statue. A finger cannot survive separation from the body and remain a finger. Even flesh and bone, although their activities are less immediately evident, are truly flesh and bone only when part of a functioning animal (cf. *Metaphysics* 1035b22-27, 1036b27-32, 1040b5-16, *de Gen. An.* 734b25 ff.). So in the case of ensouled beings, the matter of which the soul is predicated only is what it is *when ensouled*. This dependence is reflected in the *definitions* of the parts: the parts are *logically* (and hence ontologically) posterior to the whole since their definitions must make reference to the whole ensouled organism:

And the account of the right angle does not resolve into the account of the acute, but that of the acute into that of the right. For someone defining the acute must make use of the right since "acute" is "less than a right angle". And the circle is similarly related to the semi-circle, for the semi-circle is defined by the circle, and also the finger by the whole; for a finger is such-and-such a part for a man. So whatever are parts in the sense of matter, into which a thing is resolved as into matter, are posterior... (1035b6-12).

Similarly, the entire organic body of which the soul is predicated must be logically posterior to the soul since without the soul *it wouldn't be the sort of body it is*. Definition of the body must make mention of the soul and its functions.

It is perhaps apposite to remark here that there is every reason to believe that Aristotle would have considered the ultimate form, the species, of an animal to make the matter peculiar to that species. There is sometimes a tendency to think of different sorts of animals as being made of flesh and blood in the way cups and saucers can be made of clay, as if only the *arrangement* of the parts differentiates the species. But is anything so obvious as that horses are made of *horse-flesh* and humans of *human flesh*? There is clearly an intrinsic difference between beef and pork, and I see no reason to believe that Aristotle would have thought that a pig could be made of the former and a cow of the latter. *Down to the species level* the form makes the matter what it is.

(8) The non-uniform parts are those whose own parts are not of the same sort. Thus, a part of a face such as a nose is not itself a face. In contrast, a part of flesh is itself flesh and a part of bone, bone.

It might also be remarked that this definitional dependence of the matter of an animal on its form is a *stronger* relationship than that of hypothetical necessity. It is not just that the performance of the psychic functions requires a certain kind of matter, as the function of a saw requires it to be made of iron (*Physics* 199b34-200a14). The strongest possible case of hypothetical necessity would be that where the form or function of an object entailed precisely the sort of matter from which it must be made, from iron, say, or such-and-such a sort of iron. But even in this case, the being of the matter would not depend on the form: it is no definitional part of being iron, for example, that it be made into a saw. In the case of an animal, it is not just that the form requires a particular sort of matter to be realized, but that the matter essentially requires a particular kind of form.

This dependence of the subject on its predicate in the case of predicating a substantial form of matter permits Aristotle to escape the Z. 3 aporia. Since the being of the matter is not logically distinct from the being of the form,⁹ the abstraction process cannot be carried out. Form and matter, in the case of composites such as animals, manifest the sort of *unity* which is the hallmark of true substances. Much of *Metaphysics* Z, H, and Θ is devoted to the explication of how such a unity is possible. In the case of the unity of matter and form in a composite, the problem is originally motivated by the Z. 3 puzzle.

The definitional and ontological dependence of matter on substantial form presents Aristotle with a new problem to solve. For he still wants to maintain that the two, as subject and predicate, are not identical. In the case of the part-whole relation this is easy to maintain: although "man", and hence "soul", must be mentioned in the account of a finger, it is clear that the finger is not identical to the man, the part to the whole. But in the case of the relation of the whole organic body to the soul the problem of definitionally *distinguishing* the two becomes acute. A man can survive without a finger, and not vice versa, demonstrating the priority of the former to the latter. An animal body cannot, strictly speaking, exist without an animal soul, but neither can the soul exist without the body.¹⁰ Aristotle is therefore

(9) In saying that the being of the matter and that of the form are not logically distinct. I do not mean to imply that they are *identical*, just that one must make reference to the form in defining the matter. It is this degree of logical interdependence that thwarts the stripping process.

(10) The ability to exist separately does not always accompany the part-whole relationship. Some parts, such as the heart and brain, are "simultaneous" with the body since it cannot live without them (1035b25-26). I will not here treat of active *νοῦς*, the one type of soul that seems not to require any body, not being associated with the exercise of a bodily part.

faced with a dilemma. On the one hand, he wants to maintain some difference, if only in account, between soul and body. On the other, any such distinction threatens to turn the unified soul-body composite into *two* things rather than one.

Furthermore, a parallel difficulty faces Aristotle when he turns to the form itself. Accounts of forms are often given by providing genus and differentia. Yet what is the logical relationship between these? Again, they clearly are not identical, but if they are *two distinct things* the unity of definition is threatened since the form defined by genus and differentia will become a plurality. More generally, all of the items cited in an account of a substance cannot themselves be substances without risking such a plurality, but neither can such an account mention only non-substances lest substances be constituted merely out of qualities (1038b23). Aristotle poses this difficulty and sketches its solution in Z. 13:

For it is impossible for a substance to be made out of substances actually inhering in it, for things which are *actually* two are never *actually* one. But if something were *potentially* two it might be one. For example the double is made out of two *potential* halves, for the actuality [of the halves] separates it. So if a substance is one it will not be made out of substances inhering in it which also exist in this way, as Democritus rightly says. For it is impossible to say that one thing is made out of two, or two out of one... (1039a3-10).

The key notion alluded to here is the distinction between *actuality* and *potentiality*. This pair of correlative terms is central to Aristotle's resolution of the problem of the unity of substance, and he devotes all of book Θ to it. The distinction is applied to all of the outstanding difficulties surrounding the analysis of definition and substance: the relation of genus and differentia; the relation of the parts of a definition to the object being defined; and our problem of the relation of form to matter in a composite substance. In fact, Aristotle often treats the problems of genus/differentia and form/matter as identical. This is not surprising: at 1024b8-9, when defining γένος (genus), Aristotle mentions that in one sense it is a subject, which is called matter (cf. 1038a6-7, 1043b31). Let us consider the solution to the problem of genus and differentia, of why, if man is by definition two-footed *and* animal, he is not two rather than one. Aristotle writes:

It is clear that if [certain Platonists] seek to define and to speak as they are accustomed it will not be possible to remove and solve the difficulty, but if there is, as we say, on the one hand the matter and on the other hand the form, and the former is *potentially*, the latter *actually*, the subject of investigation will no longer be taken to be a difficulty (1045a20-25).

A proper investigation of the actuality/potentiality distinction would take us too far astray,¹¹ but some brief observations can be

(11) A detailed treatment of these issues congenial to this account has been given by

made. In Aristotle's resolution to the problems of unity, form is actual, matter potential, final differentia is actual, genus potential. Further, the connection between these relata in a substance is much more intimate than accidental predication. The substantial form of a composite makes the matter what it is; it is the actuality, the realization of the matter.¹² Houses, books, boxes, etc., all of which have separately identifiable matters (stones, beams, pages, boards, etc.) are not really substances for this reason, although they do have forms which account for their most important properties.¹³ This fundamental definitional unity of form and matter as potential and actual solves both the Z. 3 dilemma and the difficulties about the unity of a substance and of a definition:

So the final matter and the shape are one and the same thing, the one potentially, the other actually. So to seek the cause of a unity is like seeking the cause of its being one. For each thing is some *one* thing, and the potential and the actual are in a way one... (1045b17-21).

Having shown that there are independent textual grounds for suspecting that the Z. 3 argument is not in *propria persona*, and having demonstrated that the argument relies on an explicit premise, *viz.* the logical distinctness of predicate and subject, which Aristotle elsewhere rejects in his account of form and matter, all that is left is to suggest a possible source for the Z. 3 puzzle. As this question is quite tangential to our main purpose, and the proposal made shall be highly conjectural, I shall only touch on the topic.

Perhaps the most obvious place to locate the source of the Z. 3 puzzle is in the *Timaeus*. In that treatise space is introduced as a receptacle for the forms, in which they are realized only transiently and imperfectly. In order to receive the forms, the receptacle itself must be inherently characterless, like the matter of Z. 3 (*Tim.* 50d-51c). This passage surely forms part of the background of Z. 3. But if the

Mary Louise Gill in [Gill ms.]. I have drawn from her insights into the nature of composite substance in the following sketch.

(12) The differentia similarly transforms and realizes the genus in each particular case. Aristotle says that the animality of a horse differs from the animality of a man, the species differentiating the genus itself non-accidentally (cf. *Metaphysics* I. 8 1057b32 ff.). If so, one can no more abstract the genus from the differentia in a given case than the matter from the form. Thus the genus as such is potential in an even deeper sense than just as being a determinable which has no existence apart from determinates.

(13) The examples are given at 1042b12 ff., the denial of their being substances at 1043a4. I take αὐτῇ ἢ ἐνέργειᾳ at 1043a6 to mean that in a substance the form is the actuality of the matter of which it is predicated (as opposed to just being the actuality of the composite). The form of a house is the actuality of the house, it is what makes the house be a house. But being-part-of-a-house does not make a *stone* what it is, while being-part-of-an-animal does make *flesh* what it is. Not surprisingly, parts of animals and heaps of elements also fail to be substances (cf. 1040b5 ff.).

distinction between *logical* and *physical* arguments for prime matter is sound, the *Timaeus* must fall in the physical camp. Space is said to be characterless in itself because of the extreme *mutability* of the images engendered in it, because of the transmutation even of the elements into one another. The passage which leads up to the introduction of space focuses not on questions of predication or definition but on the complete instability of spatio-temporal objects (48c-50d). But we can find a less apparent source of the Z. 3 argument if we turn to another Platonic work which wrestles with many of the same problems which confront Aristotle in the *Metaphysics*: the *Theaetetus*.

Although the early sections of the *Theaetetus*, which deal with the thesis that knowledge is perception, are not particularly relevant to the concerns of the *Metaphysics*, it is clear that the final section, from 201d to the end, must have been before Aristotle's mind when he wrote the central books of his treatise. In this last part, Plato considers the suggestion that knowledge is true belief with an account (λόγος) of the thing known. This raises the question of what sort of entities have the appropriate kind of account, and of the nature of an account, just the problems of definition which Aristotle must face. Thus, for example, Plato discusses whether an object of knowledge can have parts, or be the sum of its parts, at 204a-206a, and Aristotle examines these same question in Z. 10-11. More precise parallels can be found throughout the two works.¹⁴ This last section of the *Theaetetus* begins with Theaetetus and Socrates considering a new account of knowledge, one which each has heard somewhere :

I seem to have heard some people say that the fundamental elements, as it were, from which both we are composed and everything else, don't have an account (λόγος). For each of these in and of itself can only be named, and it is not possible to say anything more, either that it is nor that it isn't. For that would be to append "substance" or "not substance" to it, but one must attach nothing to it if one is to express that thing itself alone. So one must not attach "that thing" or "itself" or "alone" or "this" or any of the other many such terms. For these run all about being attached to everything, being distinct from that to which they are attached (ἕτερα ὄντα ἐκείνων οἷς προστίθεται). But if it were possible for it to be defined (λέγεσθαι) and to have an account peculiar to it, it would be defined without all of the other terms. So it is impossible to express any of the fundamental elements in an account, for it is not possible to do anything but to name it alone... (201e-202b).

This account shares essential features with the Z. 3 argument. It is logical rather than physical. It argues that the ultimate elements of any account must themselves have no account. Not even "substance"

(14) Compare, for example, *Theaetetus* 208d with *Metaphysics* 1040a27-b2; 205a with 1043b36-44a2; and 203d ff. with 1041b11 ff.

can be predicated (in Plato's terminology "προσφέρεσθαι" or "προστίθεσθαι") of them. Aristotle simply adds a method for arriving at one of the these ultimate elements: stripping off predicates successively from the subject until one has a subject of which nothing is essentially predicated.¹⁵

There are some obvious differences between the Z. 3 argument and the dream passage, but beside the evident linguistic similarities, I believe the underlying philosophical moral to be identical. The most salient difference is that whereas the *Metaphysics* analysis arrives at an amorphous "stuff", the *Theaetetus* argument ends with ultimate named *particulars*. The problem arises because one begins with a concrete particular and can pursue its analysis in several different ways. Both passages trace out the implications of the assumption that such a particular can be successively analysed into a distinct form and matter, or predicate and subject, of which it is the logical sum. If one then asks, at each step of the analysis, from which part the *particularity* of the particular comes, one is ultimately faced with a dilemma. On the one hand, since the form or predicate is always a *universal*, the particularity would seem to always be inherited from the subject or matter. Following this line of thought, as Plato does, one ends with particulars which have no characteristics in common with any other, and which can only be named, not defined and not known (cf. 203b3 ff.). That is, one arrives at a sort of bare particular. Aristotle, on the other hand, first strips off all of the universals and then notes that what remains *cannot* be a separable individual since it has no identifiable properties. Plato would surely also have endorsed this conclusion, since for him an object is some *one particular* object only in virtue of participating in the Form of Unity. Indeed, the *Parmenides* explores the difficulties which arise from regarding unity and existence as entirely

(15) As we have seen, the real trouble comes when we reach the point at which substance is predicated of matter and we must try to separate the matter from substantial form. One might also trace out the other branch of the division at this point, the *predicate*, and run a similar argument. This is just what Aristotle does at *Metaphysics* B. 5 1001b27 ff. By an identical process to that of Z. 3 Aristotle strips off all the affections, motions, relations, arrangements and ratios (λόγος) of bodies as not being substance. But when considering whether surface is more of a substance than the body it defines (or bounds), Z. 3 opts for the subject, the indefinite extension, while B. 5 selects the bounding surface. This line of attack leads not to prime matter as the ultimate substance but to points and lines. But surfaces, lines, and points are divisions of *bodies* (1002a18), present in them only *potentially* (1002a20), and so cannot themselves be substances. From Aristotle's point of view, the Platonic/Pythagorean analysis of physical entities into a combination of the (ontologically prior) limit and the unlimited, or the one and the indefinite dyad, yields the B. 5-Z. 3 dilemmas. For the unlimited is too indefinite to be substance, while unit measures are posterior in account to the substances of which they are measures (cf. *Metaphysics* N 1087b33 ff.).

separate Forms. Plato would insist that any true substance must participate in the Form of Unity, and hence that the elements of the dream passage can be neither substances nor particulars.¹⁶

To summarize this section, then, we have the following results. In Z. 3 Aristotle presents an argument which reveals a difficulty in understanding how physical objects can be substances. One usual mark of substance is being the bearer of predicates, but if we continually abstract the subject from the predicate in analysing a material object we shall ultimately arrive at an entirely indeterminate matter which seems not to be substance at all. I have argued that Aristotle does not accept the Z. 3 abstraction process as universally feasible. It conflicts with remarks he makes elsewhere. More importantly, it requires a premise, the universal logical distinctness of subject and predicate, which Aristotle will reject in his discussion of matter. The potentiality/actuality distinction provides Aristotle with an account of how matter and substantial form can be unified in definition, thereby blocking the Z. 3 regress. Finally, a plausible source for the Z. 3 argument can be found outside Aristotle's works in the *Theaetetus*.

Understanding Aristotle is a worthy end in its own right, but I have not presented this account purely as *explication de texte*. The Z. 3 puzzle is central to all metaphysical analyses concerned with physical substances. If one wants to identify substances as bearers of properties, the relationship between the predicate and the subject must be carefully considered. We must chart a path between the Scylla of bare particulars and the Charybdis of Leibnizean complete concepts if we seek to maintain that some, but not all, of the predicates of an individual make it the thing it is. In the following section we shall apply this moral to a problem of contemporary metaphysics: the ontological status of space-time.

PART 2: THE ESSENCE OF SPACE-TIME

Although the Scholastic metaphysics of substratum and substantial form, accident and essence, was resolutely rejected during the scientific revolution, fundamental questions of ontology, and hence of metaphysics, cannot but be revived by changes in the foundations of our theoretical understanding of the world. Newtonian dynamics challenged the mechanical world-view, special relativity rejected not only absolute space but the categorical distinction between spatial and

(16) The differences between the Z. 3 passage and that of the *Theaetetus* were impressed upon me by Sarah Brodie, which is not to say that she will be satisfied by my attempt to establish their fundamental philosophical unity.

temporal properties, and general relativity replaced the static space-time continuum with one dynamic and non-(pseudo)-Euclidean. But mathematical formulæ do not immediately yield up ontologies, and the most sweeping changes in theory are also the most subject to varied interpretation. We are still trying to come to grips with a theory introduced over 70 years ago: Einstein's general theory of relativity. Despite the striking mathematical clarity and beauty of the theory, it can be rather sibylline in its pronouncements about the ultimate furniture of the world.

The special theory of relativity welded space and time into a unified space-time continuum which admits of no unique partition into spaces-at-a-time. Still, as a 4 dimensional object, Minkowski space-time has a fixed universal geometrical structure. The primary insight of the general theory was to allow the geometrical structure itself, the space-time metric, to become a dynamic entity influenced by the distribution of matter and energy in the universe. Einstein often motivated this change, in part, by an appeal to a sort of generalized version of Newton's third law: since the trajectories of massive particles are determined in part by the inertial structure of space-time, the inertial structure should itself be affected by the particles.¹⁷ This seems to elevate space-time and the metric into *physical objects co-ordinate with material particles*. Having sacrificed the magisterial aloofness from mundane events which the space-time of special relativity enjoyed, the space-time of general relativity becomes a dynamic physical entity.

From this point of view, general relativity seems to establish space-time as a sort of physical substance, capable of entering into reciprocal causal interaction with the commoner class of objects such as tables and chairs. That Einstein so regarded it is suggested by his reference, in several articles and addresses, to the "aether" of general relativity.¹⁸ One is tempted to regard the space-time of general relativity as an immaterial rubber block, contorted and twisted by the matter in it. Still, nothing amounting to an argument has been

(17) Cf., for example, Einstein (1956) pp. 55-56. That Einstein took this generalized law of action and reaction seriously as a physical principle, and did not use it just as a rhetorical device, is evidenced in his research into unified field theories. In 1929 he rejected a set of field equations proposed by Elie Cartan because he believed that they allowed a causal influence of the metrical structure of space on its parallel structure without positing a causal connection in the other direction (Cartan and Einstein 1979, pp. 73-74, with responses on pages 81 and 89).

(18) Three examples are cited by Norton in Norton 1987, p. 183. Arthur Fine has stated that Einstein had earlier drawn exactly the opposite inference, that the general theory stripped space-time of all physical reality (Fine 1984, p. 91). I argue in the appendix that this impression is only created by taking certain passages out of context, where they refer not to the physical reality of space-time but to the physical significance of *coordinatizations* of space-time.

produced, and the mathematical entities introduced in a physical theory are always vulnerable to being analyzed away, shown to be fictions or abstractions which don't directly represent the physical reality. And recently John Norton and John Earman purport to have found an argument which demonstrates that if determinism is to have a chance, space-time *cannot* be a substance.¹⁹ It is this argument which shall be our focus in this section. Before presenting it, we must briefly review the mathematical structure of the general theory.²⁰

Our project is to construct a mathematical object which represents the universe. We shall do this by beginning with mathematical simples and adding on successive layers of structure. One must keep in mind that the (abstract) ontological structure of the mathematical representation may suggest, but does not entail, an analogous metaphysical analysis of the physical structure that it represents. Indeed, one of my main contentions is that a failure to distinguish between the ontology of the mathematical representation and that of the thing represented has led to Norton and Earman's conclusion.

We begin with a simple collection of *points*. The points are pure abstract individuals, bare mathematical particulars which, initially, bear no properties and enter into no relations. Still, as mathematical objects they are distinct individuals. If you like, you can call these objects *space-time points*,²¹ but one must bear in mind that they do not as yet have any spatio-temporal properties and that nothing yet suggests that the set is particularly suited to represent space-time. That is, as mathematical objects space-time points do not differ from any other kind of points — they only become connected with

(19) The papers in which this line is developed are Norton 1987, Earman ms., and Earman and Norton ms. Norton, in [Norton 1987] claims to find this argument in Einstein's papers of 1913 and 1914. See the appendix of this paper for some observations on Norton's claims.

(20) Throughout this section I have striven to avoid technical detail, although some familiarity with the theory is presupposed in certain of the footnotes and in the appendix. I have no quarrel with the mathematical detail of Earman and Norton's argument, only with the ontological interpretation of it. I hope my somewhat intuitive sketch captures the fundamental structure of the argument simply and clearly.

(21) There is an extremely unfortunate ambiguity in the term *space-time points*: sometimes it refers to elements of the mathematical object which represents space-time, and sometimes to physical events. This ambiguity should be kept in mind when reading this paper and when comparing the locutions here to other works. I hope that my intention will always be clear in context. This confusion of mathematical representation with thing represented infects much mathematical physics. For example, it is perfectly natural to say that temperature is a scalar field and that a scalar field is a mapping from space-time points (ambiguous!) into the reals, which seems to imply that temperature is a sort of mapping. One of the "is" clearly must mean "is represented by", but I can't even say which because of the ambiguity of "field" as between physical entity and mathematical representation.

space-time because of further structure defined on them. Also, one might say that these space-time points are to represent *events*, minimal regions of (physical) space-time.²² But this is a tendentious statement, since one of the questions raised by the argument we are considering is whether such points *do* or *can* represent events (cf. Norton 1987, p. 157).

The first structure we invest the set of points with is *topological* structure. This entails specifying which subsets of the set constitute *open neighborhoods*. This structure makes our set of points into a *manifold* (also called a topological or differentiable manifold). With such a structure we can now characterize continuous curves on the manifold and continuous mappings from one part of the manifold to another. We can lay down sets of co-ordinate curves, assigning to each point a unique n-tuple of real numbers. We can determine the dimensionality of the manifold by finding the minimum number of such co-ordinates needed to specify each point. We can define a derivative of curves. In the context of classical relativity theory we choose a 4-dimensional manifold.

Two points need to be made about the topological manifold. First, it does not yet have any structure which represents spatio-temporal properties and relations. No notion of distance between points is yet defined, no distinction can be made between time-like and space-like intervals. There is nothing by reference to which lines can be characterized as straight or curved, and hence no grounds upon which to prefer one co-ordinatization of the manifold to another. There is nothing in the bare topological manifold which would answer to the notion of spatio-temporal location.

Second, the topological structure generally does not itself ascribe different properties to different regions of the manifold. Although one may have regions which differ topologically from others because (loosely speaking) there are "holes" in the manifold, most neighborhoods are topologically identical to one another. They inherit their individuation, so to speak, from the fact that the points were individuated *ab initio*.²³

(22) Events are often likened to physical occurrences infinitesimally localized in space and time, like the explosion of an (infinitesimal) firecracker. However, this is slightly misleading since there need not be a physical happening in a region of space-time in order that there be an event there.

(23) One could reverse the ontological picture here, and posit the open neighborhoods as the primitive individuals. One can then add a (transitive, asymmetric) subset relation to the collection of neighborhoods and *define* points as ideal objects represented by certain infinite sequences of neighborhoods. Roughly, a point is a sequence of neighborhoods such that each is a subset of the preceding, and such that no neighborhood is a subset of all of those in the sequence. Two sequences represent the same point iff every open neighborhood in one sequence has a subset in the other. Ultimately this may be a better ontological model for space-time, but because of certain counterintuitive

To repeat: the topological manifold as such has no geometrical properties, and hence no mathematical resources to represent the spatio-temporal structure of the world. Geometrical structure must be added, and this is done by means of two mathematical objects. *Straight lines* can be defined by adding an *affine connection* to the manifold, yielding an affine space. The affine connection ties together the tangent spaces at different points of the manifold, so that one has the notion of a vector pointing in the same direction (or pointing parallel to itself) as it travels along a curve. Spatio-temporal *distance* relations are represented by means of a *metric* defined at each point of the manifold, whose addition turns the manifold into a *metric space*. Since we want the straight lines also to be curves of shortest distance between points,²⁴ we must adapt the affine connection and the metric to one another. If we further require that the connection be symmetric, then only one connection is compatible with a given metric, so that we can specify the entire geometrical structure of the manifold by specifying the metric alone.

It is differences in the metric which distinguish between the mathematical space-times of Newtonian physics, of special relativity, and of general relativity. Newtonian space and time are represented by a degenerate metric which foliates the 4-dimensional manifold into a unique sequence of 3-dimensional spaces-at-a-time. The geometry of these spaces is the flat metric of Euclidean geometry.²⁵ Special relativity employs the Minkowski metric, which creates a true 4-dimensional space-time continuum. As in Newtonian theory, the metric is the same everywhere. Although the Minkowski space-time singles out no unique simultaneity relation between points, it does single out certain frames of reference or co-ordinatizations as special. These co-ordinatizations represent the inertial frames, in which the laws of physics take a particularly simple form, invariant between frames. Finally, the space-time of the general theory of relativity is represented by a manifold with a variable metric, whose geometry need not be Euclidean. The equations of the theory are *generally covariant*, which means that they are the same no matter what co-ordinate system is adopted. Both Newtonian and special relativistic theories *can* be given a generally covariant formulation, but they also admit of

features we won't pursue it. For example, the neighborhoods are only in a Pickwickian sense sets of points: one can define an "element of" relation (points are elements of the neighborhoods in the sequences representing them, a neighborhood has as elements all of the points in whose sequences it appears), but the "sets" here are ontologically *prior* to their "elements", reversing the usual picture.

(24) Rigorously, we want them to be curves of *extremal* distance in a Riemannian metric.

(25) Newtonian physics also presupposes a *global* condition that the space-time be topologically R^4 : infinite in all directions.

particularly simple formulations in the inertial frames. In the general theory there are no such preferred co-ordinatizations.

Now that we have a mathematical space-time, we can add more mathematical structure to represent the rest of the furniture of the world.²⁶ We can add objects representing massive particles, electromagnetic fields, strong gauge fields, & c. Einstein's general relativistic field equations relate the distribution of matter and energy in the world to the space-time metric. The "bending" of the metric due to matter is gravitation. Since the general theory is formulated in a generally covariant manner, these objects and fields must be represented by mathematical objects whose characterization is independent of co-ordinatization. Such mathematical objects are called *tensors*.

In this context a physical theory is a set of differential equations which relate the various mathematical objects — tensors, metric, and connection — to one another. A *model* of a theory is a manifold with mathematical objects defined on it such that the equations of the theory are satisfied. Two models defined on the same manifold are different *mathematical* objects if they assign tensors differently at least one point.

We are now in a position to undertake the problem which Earman and Norton raise for those who seek to regard space-time as a substance. First of all, take any model of the field equations. Let us suppose that we have laid down some co-ordinates such that, in this solution, the co-ordinate curves are geodesics (straight lines) in the manifold (given the metric of the solution). Further suppose that the equations say that material particles travel along geodesics. One bit of the model might look like this :

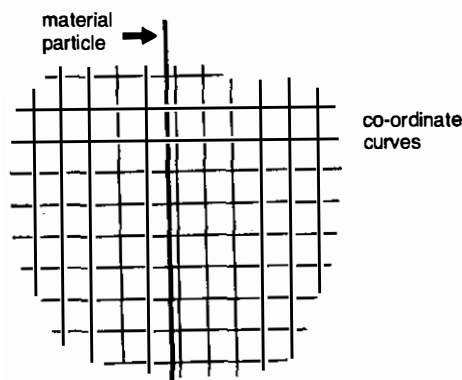


Fig. 1. — A material particle in space-time.

(26) Not everyone would continue in this way. The "geometrodynamics" of J. A. Wheeler proposes to represent material objects as kinks in the geometry of space-time. We shall have cause to comment on this later.

A *diffeomorphism* is a continuous one-to-one mapping from the manifold onto itself. It uniquely associates with each point in the manifold another point, in such a way that open neighborhoods are mapped onto open neighborhoods. Earman and Norton ask us to consider a *hole diffeomorphism*, that is, a diffeomorphism which is the identity map (maps each point onto itself) outside of some bounded region. Points are mapped to points other than themselves only within the hole: e.g.

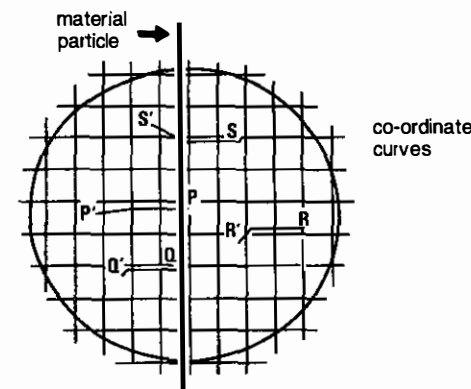


Fig. 2. — A diffeomorphic mapping.

One way to think of this is as if the hole is made of rubber firmly attached at the edges and is pulled without tearing. Point P is pulled over to where point P' used to be, & c. In this way each point in the hole becomes mapped onto another point in the hole. So far we haven't *done* anything to the model, we have just defined a mapping from the manifold onto itself. But we can use this mapping to define a *new* distribution of geometrical objects on the manifold in the following way: pick up the metric and other physical tensors from each point and move them to their image points under the mapping.²⁷ This induces a new

(27) At this point I have radically oversimplified in order to avoid technical detail. The problem is that there is no way to compare tensors at different points in the manifold to see if they are "the same". You can't just pick up a tensor and drop it somewhere else. The trick is this: first express the tensors in co-ordinate form relative to the original co-ordinatization. Second, let the original co-ordinate curves generate a new set of coordinate curves, in which the new curves are the images of the old ones under the diffeomorphism. Of course, outside the hole the old co-ordinates map onto themselves. Finally, define the *new* tensors as those which have the same functional form relative to the new co-ordinates as the old ones had towards the old co-ordinates. These new tensors are called the *carry alongs* of the old tensors under the diffeomorphism. See Earman's and Norton's papers for the mathematical details of the operation.

assignment of tensors on the manifold. For example, our old model would yield a particle trajectory which would look like this under the diffeomorphism:

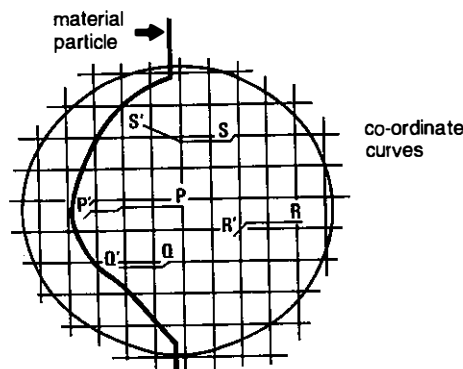


Fig. 3. — The carried along particle trajectory.

Mathematically, this new model is a distinct object from the old. For example, whereas in the old model the material particle passed through point Q , in this model it doesn't (of course it does pass through the *image* of Q). But the vital result is the following: *If the old model satisfied the field equations, so does the new one.* This may at first blush look wrong. After all, the equation says that all material particles travel along straight lines, but now the trajectory seems curved. But remember that in defining the model we picked up *everything* and moved it, including the metric, which determines which lines are straight. In the old model the co-ordinate curves were geodesics, but in the new model they are not (the *images* of the co-ordinate curves would be geodesics of the new metric). Intuitively, it should be clear that the new model also satisfies the equations. For, as we noted, the topological manifold does not have any internal structure which would inherently distinguish one neighborhood from another or prefer one co-ordinatization to another. But the *only* difference between the two models is which particular neighborhoods the tensors occupy.

The dilemma can now be posed. We have two distinct mathematical models of the field equations which agree everywhere outside the hole but give different solutions inside the hole. If one is obliged to regard each of these models as representing a distinct physical of affairs, then the laws which govern the world would be radically

indeterministic. For given any region, no matter how small, a complete specification of the physical state of the universe outside the region plus the field equations do not fix the physical state of the world within the region.

Of course, so far we only have a *conditional* dilemma. If one regards the diffeomorphically generated mathematical models as representations of distinct physical possibilities, then radical indeterminism follows. Not surprisingly, physicists do not so regard the models. They would consider that the two models represent the same physical state. But Earman and Norton argue that *if one regards space-time as a substance one must accept the models as representations of distinct physical states.* Here, according to them, the substantialist faces a dilemma: either he must accept radical indeterminism or abandon his substantialism (cf. Earman & Norton ms. p. 15, Norton 1987 p. 180).

Now the mathematics which Earman and Norton present, and which I have crudely sketched, is quite unexceptionable. However, the lynchpin of the arguments is not a piece of mathematics but a bit of metaphysics. It is here that we must focus our attention: What is it to regard space-time as a substance? How does such an ontology constrain one's interpretation of mathematical representations? For I do not believe that Earman and Norton establish that a substantialist must be committed to regarding the models as representing distinct physical states. Indeed, I believe that they, lured on by the peculiar abstract ontology of mathematical representations, have fallen into the very problem that Aristotle uncovered in *Metaphysics* Z.3. But instead of attacking their arguments directly, I want to approach the problem a bit obliquely, by allowing the arch-substantialist, Newton, to speak in his own defense.

We must first note that there is nothing about the hole argument which makes it particularly appropriate only to the general theory of relativity. Models of the special theory, and of Newtonian dynamics, and even of Newtonian dynamics with absolute space are also 4-dimensional manifolds with various geometrical objects defined on them.²⁸ All of these theories can be given covariant formulations. So if the indeterminism problem arises, *prima facie* it arises for everybody. This is somewhat surprising since Newton's theory, especially with absolute space, has been regarded as a paradigm of both substantialism and of determinism.²⁹ Earman and Norton assert that

(28) A covariant presentation of the theories is given, for example, in Friedman 1983.

(29) John Earman has already revealed indeterminism of a rather different sort lurking around the edges of Newtonian theory, but even he regards the special theory of relativity as close to the ideal of deterministic theories. See Earman 1986 for details.

a metaphysics which forces us to be indeterminists must be unacceptable: determinism must at least have a fighting chance of being true, contingent on physical facts (Earman & Norton ms. p. 14, Earman ms. p. 20). Equally, it seems to me, an interpretation of the mathematical formalism which makes substantivalism *imply* indeterminism, irrespective of the details of the physical theory in question, is unacceptable. If not even Newtonian theory can be interpreted substantivally without radical indeterminism, substantivalism is not being given a fighting chance.³⁰ How, then, would Newton reply to the argument?

As the order of the parts of time is immutable, so also is the order to the parts of space. Suppose those parts to be moved out of their places, and they will be moved (if the expression may be allowed) out of themselves. For times and spaces are, as it were, the places as well of themselves as of all other things. All things are placed in time as to order of succession; and in space as to order of situation. *It is from their essence or nature that they are places; and that the primary places of things should be movable, is absurd.* (Newton 1686, p. 8, my italics.)

Newton insists that the parts of space and time have their spatio-temporal relations *essentially*, and any talk of such parts changing their spatio-temporal properties is evidently confused. For if they do bear these relations essentially, by what (metaphysical) means could one identify a displaced place (one which had changed its spatio-temporal position relative to other places) as the very same place? To hark back to Aristotle, one might say that places are themselves in places, or that places are subjects to which the predicate "occupying such-and-such a relative position with respect to these other places" truly applies. But that predicate applies to a place essentially. However, Earman and Norton's interpretation of the hole diffeomorphism requires the substantivalist to reject Newton's claims. Under their interpretation, space-time points (*physical*, not mathematical, space-time points) only possess their spatio-temporal relations *accidentally*. Points which were represented as being 2 meters apart in the original model, *those very points*, may be represented as being 8 meters apart in the diffeomorphically generated model. Points may be represented as changing their temporal sequence in different models: in one model *p* occurs in the absolute past of *q* while in another *q* occurs in the absolute past of

(30) Earman does give Newton a proposed response, along the lines that since his space-time structure is fixed and unaffected by matter distributions, he can regard all models as employing one and the same space-time (Earman ms. p. 19, cf. also Earman and Norton ms. p. 7). As will see below, the mutability of space-time, in Earman's sense, has no bearing on the question; and the immutability of places and times, in Newton's sense, is equally defensible in the context of the general theory of relativity.

p. Newton the substantivalist would clearly brand such assertions as absurd.³¹

Earman and Norton's difficulty arises from asserting that *the substantivalist must regard space-time as represented by the bare topological manifold*. Since the metric tensor, as a mathematical object, is an accidental property of the manifold, they can then infer that the spatio-temporal relations between physical regions must be accidental attributes of them. This results from *mistakenly reading the ontological structure of a mathematical representation into the object that it represents*. Since the mathematical structure is built up from bare particulars, *all* of whose properties and relations are accidental, one thereby arrives at a physical ontology of bare particulars all of whose physical features are accidental. That is, by denying that any physical attributes are essential to the entities which possess them one arrives at the prime matter of Z.3, with all of its attendant difficulties.

The solution to this dilemma is just that which, I have argued, Aristotle saw. Not all predicates of a subject are accidental features of the subject. The essential features cannot be removed from the subject while leaving it behind. Similarly, moving the metric tensor from one point to another is a mathematical operation with no correlate in the realm of physical possibility. Physical space-time regions cannot exist without, and maintain no identity apart from, the particular spatio-temporal relations which obtain between them.

Since the ontological structure of the physical universe does not mirror the ontological structure of the mathematical object representing it, the mathematics must be supplemented with a *metaphysical commentary*. Earman and Norton themselves have done this in identifying space-time with the bare topological manifold and in insisting upon using a diffeomorphism, which preserves topological structure. For if one were to just adopt the ontology of the mathematics whole-heartedly, one would be forced to regard physical space-time points as entirely like the bare particulars from which the mathematical structure is constructed. But if one were to adopt *this* interpretation, one would not need to go through all of the technicalities of the diffeomorphism, for all one needs to do is *permute* the mathematical points to get a new mathematical object. That will generally alter the neighborhood structure, but that would just mean that the topological relations between physical space-time points are

(31) Howard Stein makes precisely this claim about Newton in [Stein 1977], p. 394. Stein, however, is more generous than am I in countenancing locutions in other contexts which would imply that space-time does not have its spatio-temporal metrical properties essentially.

also accidental.³² Even Earman and Norton don't think the substantivalist must be committed to regarding permuted models as representing physically different states: they accept that the topological relations are essential to physical points. Physical space-time, according to their version of substantivalism, is represented by a set of mathematical points plus a topology. The question is: Why stop there?

It is a most peculiar place to stop, for it commits the substantivalist to the belief that *space-time, and space-time points, have no spatio-temporal properties essentially*. If space-time is a substance in the universe, surely its appropriate mathematical correlate is an object which has enough mathematical structure to represent spatio-temporal properties! The substantivalist's natural response to the hole dilemma is to insist that space-time is represented not by the bare manifold but by the manifold plus metric, by the metric space.

Earman and Norton do not just presuppose that space-time is to be represented by the manifold; they provide arguments to that effect. Let us consider these arguments and some other conceivable objections to my substantivalist's position to see whether they establish their point.

Objection 1: The metric is mathematically just like the tensors representing other physical fields. The physical field it represents propagates, carries energy,³³ & c. Therefore the field must not be essential to space-time.

I answer that this is a non-sequitor. It only shows that, *pace* Newton, space-time has physical features which make it quite akin to other physical objects. All the more reason to regard it as a substance on a par with tables and chairs. One might try to turn this objection into a dilemma as follows:

Objection 2: Since the metric is so similar to the other physical fields,³⁴ how can one assert that *it* is essential to space-time and the others

(32) On the alternative mathematical ontology, in which neighborhoods are taken as primitives, this problem would arise in a different form: there the *subset relation* would be accidental, and neighborhoods could be permuted with respect to it. In some models p would be a subset of q , in others not.

(33) Albeit in a somewhat peculiar way: the energy is represented by a pseudo-tensor rather than a tensor. See Earman and Norton ms. pp. 6-7 for arguments that the energy associated with the metric is just like all other energy.

(34) There is possible escape hatch even to the objection that the metric looks too similar to the matter fields, although it is not a position I would defend. A substantivalist could argue that space-time is represented by neither the metric space nor by the bare manifold, but by an intermediate object. The affine space, the manifold plus affine connection, is just such an object. The connection is not a tensor, and the supposed problem of the gravitational energy pseudo-tensor vanishes since no such tensor is associated with the connection. The weaker structure of the affine connection still overcomes the hole dilemma, since the only affine transformation which leaves the area

not? But if *all* fields are essential, then space-time substantivalism becomes trivial: it only asserts that the whole universe is a substance.

I answer that despite the similarities, the metric has one distinguishing property: it represents spatio-temporal features! Since space-time has its spatio-temporal features essentially (cf. Newton above), the metric is essential to it and the matter fields not. Of course, if one could do physics without the metric, or show that the metric can be reduced to the matter fields, one could deny that space-time is a substance. As an aside, there are some peculiar *mathematical* features of the gravitational field equations which have been cited as evidence of a particularly intimate connection between the metric and space-time:

The Einstein equations are *non-linear*. Actually, in this respect they are not so different from other fields, for while the electromagnetic field, the scalar field, etc., *by themselves* obey linear equations in a given space-time, they form a non-linear system when their mutual interactions are taken into account. The distinctive feature of the gravitational field is that it is *self-interacting*: it is non-linear even in the absence of other fields. *This is because it defines the space-time over which it propagates.*

(Hawking & Ellis 1973, p. 227, my underline.)

Objection 3: "If we do not classify such energy bearing structures as [a gravitational] wave as contained within spacetime, then we do not see how we can consistently divide between container and contained."

(Earman & Norton ms. p. 7.)

I answer that the metaphor of container and contained is hopelessly obscure when applied to space-time. Space-time does not contain objects like a *box* contains objects (i.e. by surrounding them). It may contain objects like the space within the box contains objects, but that is not very enlightening. Two glosses of this objection are possible:

Objection 3a: Gravitational waves suggest that we cannot distinguish between the spatio-temporal and other aspects or properties of the universe.

I answer that in ordinary English, we have clear paradigms of spatio-temporal properties: distance, elapsed times, & c. We can easily

outside the hole unchanged (if it includes a Cauchy surface) is the identity map. The simplest way to see this is as follows: suppose a region of some thickness surrounding the Cauchy surface is to remain unchanged by the diffeomorphism (as will be the case with a finite hole). Since the affine transformation (a transformation preserving the affine connection) maps geodesics onto geodesics, it will map any geodesic passing through this region onto itself. But any point within the hole will lie at the intersection of at least two geodesics which pass through the Cauchy surface. Since these geodesics are mapped onto themselves, each point in the hole is mapped onto itself, and the map is the identity map. This still allows the substantivalist to regard certain *global* transformations, such as moving everything 3 feet to the left (in a flat space-time) or uniformly "stretching" space, as producing physically distinct situations, but these transformations do not give rise to any problems about indeterminism.

determine which mathematical structures in a theory represent information about these properties, in this case the structure being the metric (as opposed to the electro-magnetic field tensor, & c.). If this is an energy-bearing structure, all the better for substantivalism, as per the response to objection 1.

If we interpret "container" and "contained" as respectively "subject" and "predicate", we obtain:

Objection 3b: If the metric is essential to space-time, we cannot distinguish between the predicate (metric) and that which *has* the predicate (space-time). But such a distinction is crucial to regarding space-time as a substance, and hence as a subject (bearer of fields).

I answer that regarding the metrical properties as essential to space-time no more obliterates the distinction between subject and predicate than does regarding my humanity as essential to me. I am not *identical with* my humanity, I am the subject of which my humanity is predicated, I am the bearer of that property. Still, that does not make my humanity an accidental attribute, not does it make me into a bare particular which might have been, say, a chair. Space-time may be a bearer of the metric field but still bear it essentially. (The relevance of *Melaphysics* Z.3 is, I hope, vindicated here.)

Objection 4: "Classifying the metric as part of the container spacetime leads to trivialization of the substantivalist view in unified field theories of the type developed by Einstein, in which all matter is represented by a generalized metric tensor. For there would no longer be anything contained in spacetime, so that the substantivalist view would in essence just assert the independent existence of the entire universe."

(Earman & Norton ms., p. 7.)

I answer that belief that space-time is a substance does not become trivialized if it could be argued that space-time is the only substance (Is Spinoza's substantivalism about God trivial?). Indeed, programs such as Wheeler's "geometrodynamics" are correctly termed by Larry Sklar as "supersubstantivalist" (Sklar 1977, p. 221 ff.). The only sense in which unified field theories such as Einstein's could trivialize substantivalism is if the metric is *artificially* expanded and information about other structures just pasted on (in which case, the substantivalist response to Objection 2 would be undercut). Einstein's theory was arguably not of this sort: he attempted to represent electro-magnetism as an affect of the parallel structure of space-time, which is clearly a *geometrical* property. Distinctions can usually be drawn between theories which try to show that physical effects flow from the metrical structure and those which artificially inflate the metric or the dimensionality of space-time to code up more information (cf. Weingard ms.). If in certain cases such a judgement were disputable, it would still be fair to say that if the paradigm geometrical properties of space-time are ineliminably represented by the metric, then the substance

which is the universe is as much correctly called "space-time" as it is "material body". Finally, the supersubstantivalist program is certainly not trivial in the sense of being guaranteed to succeed: no one has yet made it work. Our best theories say that there is more to the universe than just space-time.

In arguing that substantivalism about the general theory is inescapably subject to the hole dilemma in a way that Newtonian and special relativistic theory may not be, Earman introduces the notion that in the general theory space-time is *mutable*:

Finally, assume space-time *mutability* in the sense that the object fields which characterize the structure of space-time are not given *ab initio* but are regarded as dynamical objects on a par with the other fields. In any such theory substantivalism will be incompatible with Laplacian determinism...

(Earman ms. p. 18, cf. also p. 19.)

Earman acknowledges the charge that the notion of mutability is "so vague as to be useless", but feels that paradigm cases are clear enough to deploy the concept. The question we must address is twofold: In what sense is the space-time of the general theory mutable? And what bearing does mutability have on substantivalism?

It is unclear why Earman wants to designate the feature of being governed by local differential equations (rather than by global constraints) as "mutability". The only connection I can think of (which I would not attribute to Earman) is associated with a peculiar causal reading of the mathematics. The picture is that although the physical metric field is not given *ab initio*, the physical bare manifold *is*, and then the metric "propagates" along the manifold. This of course is nonsense: a model may *represent* objects propagating in space-time, and equations may state mathematical conditions relating the value of the metric tensor at some point to its value at points infinitesimally close, but the space-time metric does not propagate or "move". For the manifold and metric are not in time, time is in them.

The notion of *ab initio* which Earman invokes is obscure to me. A mathematician may, in explicating or constructing a mathematical object, begin by laying down some structure, but that does not mean that the object it represents is somehow metaphysically "laid down" first. "*Ab initio*" must here refer to the physical objects, not to the mathematical representation. But it cannot be given a temporal reading, and I don't know how to read it.³⁵

(35) We might note in association with this that it is rather difficult to clearly explicate the many causal locutions that are used about how the metric is *generated* or how it *interacts* with matter. Reconciling causal locutions with the God's eye view of the mathematician is deeply puzzling. This problem also arises in disputes about the coherency to talk about time travel into the past, and even raises its head in the passage from Hawking and Ellis cited above.

It is true that according to the general theory of relativity the geometrical structure of space-time *depends on* the matter fields in the universe. In this sense, as opposed to Newtonian theory and the special theory, one cannot specify what the correct mathematical representation of the space-time structure is before one knows the disposition of objects. But if *this* is the appropriate sense of "*ab initio*" then the manifold is also not given *ab initio*: matter distributions can also determine some of the topological structure of space-time, as when a black hole requires there to be a singularity.

The straightforward reading of "mutability" suggests that space-time as a whole, or regions of it, can alter its geometrical properties. Clearly, space-time cannot do this in the sense that a persisting 3-dimensional object can, i.e., by having *as a whole* different shapes at different times. Different *parts* of space-time may have different geometrical properties, but that no more implies mutability than does the fact that different parts of the Hope diamond have different shapes. Hence, the only viable reading of "mutable" here is counterfactual: space-time is mutable in the sense that parts of it, or it as a whole, *might have had* geometrical properties other than the ones they do have. But such a counterfactual is not implied by the mathematical form of the field equations! The substantialist would evidently deny that, strictly speaking, this very space-time could have had different spatio-temporal properties. Of course, had the matter fields been different, a space-time very *similar* to this one might have existed. It is quite open to the substantialist to be a counterpart theorist about the counterfactual locutions that physicists are wont to use. There might have been other spacetimes, as would have been described by the various non-isometric models of the theory. Some of these are sufficiently like our space-time to provide counterparts to regions of actual space-time and so to support counterfactuals about what would have been the case if... But those counterparts are not *these very* spatiotemporal regions.³⁶ In any case, counterfactuals about space-time, like all counterfactuals, are puzzling beasts, and it is not obvious that the non-substantialist will fare any better.

(36) This is not to say that one must be a modal realist to be a substantialist. Kripke might object that we can *stipulate* that we are counterfactually talking about *this very* region (cf. [Kripke 1980] pp. 43-47), but he runs afoul of the very problem of essential properties. For he admits that not every such stipulated possibility is metaphysically possible; there is, for example, no possibility that Nixon might have been a chair (cf. *ibid.* pp. 110-116). Our substantialist can adopt Kripke's view of counterfactuals, but must insist that the geometrical properties of an individual space-time be considered essential to it.

The only non-question-begging sense in which the space-time of the general theory of relativity is *mutable*, then, is the sense in which its geometrical properties are posited to depend upon the matter fields via the Einstein field equations, so that different parts of space-time may have different metrics and models of the theory may be non-isometric. What bearing does this have on substantivalism? One possibility is:

Objection 5: Substances are supposed to be capable of independent existence. You say that space-time has its geometrical structure essentially. But then it should be capable of independent existence apart from the matter fields. But if we remove the matter fields, we change the metric (via the field equations) and so destroy the space-time.

I answer that this objection rests on a confusion of physical and metaphysical necessity. If all American families were increased by one member, then the average American family would as a *logical* consequence also be changed. The average family cannot exist independently of the flesh-and-blood ones, and its properties are entirely determined by theirs. No such *logical* or *necessary* connection is evident in the case of the metric.³⁷ The substantialist can regard the field equations as *conlingent* truths, so that it is *metaphysically* possible for a particularly curved space-time to exist even if all of the matter in it were annihilated. Similarly, I cannot physically exist without there being surrounding air, but this does not debar me from being a substance.

Objection 6: So far, you have only dwelt upon what the space-time substantialist need not be committed to: he need not regard space-time as represented by the bare manifold, need not regard counterfactuals as indicating possible geometrical states of this very space-time, & c. Let us consider what the substantialist must *accept*. Substantialists, whatever their stripe, "must all agree concerning an acid test of substantivalism, drawn from Leibniz. If everything in the world were reflected East to West (or better, translated 3 feet East), retaining all the relations between bodies, would we have a different world? The substantialist must answer yes since all the bodies of the world are now in different spatial locations, even though the relations between them are unchanged." But "the diffeomorphism is the counterpart of Leibniz's replacement of all bodies in space in such a way that their relative relations are preserved. ...In sum, substantialists, whatever their precise flavor, will deny: *Leibniz equivalence*: Diffeomorphic models represent the same physical situation."

(Earman & Norton ms., pp. 10-11; cf. also Earman ms. p. 17; Norton 1987 pp. 179-80.)

I answer that although the substantialist must acknowledge the movement of every *body* 3 feet East as resulting in a new physical

(37) There may be some such non-evident connection, as the geometrodynamist would contend, but this must be argued for. Even for him, though, space-time is certainly capable of existing independently of anything else, it is just that there is nothing else for it to be independent from.

situation, it in no way follows that the diffeomorphism is the appropriate generalization of such a change. Rather, it would be the movement of the *matter fields* which a contemporary Leibniz would have in mind, not moving the metric as well. The substantivalist *does* regard the mathematical object created by replacing all of the tensors *save the metric tensor* by their carry alongs under a diffeomorphism as representing a new physical situation. In general, of course, this new physical situation won't even satisfy the field equations. It is a special feature of Newtonian and special relativistic physics that moving all material bodies in a particular solution an equal amount will result in another solution. In general relativity there is no such automatic recipe for generating one solution on the metric space from another. Indeed, in general relativity the demand that one translate everything 3 feet East while retaining all the relations between bodies is not usually satisfiable. For example, if we move a physical triangle 3 feet East from a region of zero curvature to a region of positive curvature, the parts of the triangle *cannot* retain all of their geometrical relations to one another. Either the sides will no longer be straight or the interior angles will no longer sum to π .

There is no reason to suppose that the Leibniz experiment generalizes to moving the geometrical structure of space-time as well as the material bodies, and good reason not to suppose so. First of all, if it did include the geometrical structure, it would not be necessary to specify that one should move everything an *equal* distance. Indeed, only in the case in which the metric is left unchanged does it make sense to talk unequivocally about "the distance" that an object has been moved. For suppose that under a diffeomorphism such as Earman and Norton propose one moves all of the geometrical structure from point p to point q . It will not generally be the case that the spatio-temporal distance between p and q remains invariant under the transformation! Either there is no univocal distance between the two points at all or else, if one insists upon measuring distances according to the metric from which the move is made, it will generally occur that a move 3 feet East from p to q followed by a move from q 3 feet West will not bring you back to p . It is doubtful that Leibniz could have had such a possibility in mind. But even if he did, the substantivalist can rightfully point out that it begs the question to say that all spatio-temporal relations have been retained in such a move. For the spatio-temporal relations between p and q , more generally between almost any pair of points in the hole, will have been changed. If, as Earman and Norton insist, the substantivalist must regard the bare manifold as a substance, these he can respond that the diffeomorphism does *not* leave all spatio-temporal relations unchanged. If, as I have maintained, he regards the metric space as the substance, then moving bodies around *in*

a given space-time is a different mathematical operation than the one Earman and Norton present.

Thus our substantivalist does pass the acid test — appropriately construed. In Newtonian dynamics and special relativity he would accept the movement of all matter fields or particles 3 feet East as resulting in a new physical situation, one which still satisfies the field equations. In general relativity, he would accept the moving of matter fields globally also as creating a new physical situation. If the metric were sufficiently isotropic and homogeneous, a global transformation similar to moving everything 3 feet East might be definable and even lead to a new solution to the field equations. But accepting such *global* transformations as resulting in distinct physical states raises no spectre of indeterminism, for in such a case the Cauchy surface must be changed too. On the other hand, moving the matter fields around according to a *hole* diffeomorphism will not lead to a solution to the field equations unless it is the identity map. Accepting Leibniz's "acid test" does not need to imply indeterminism.

Objection 7: Your space-time substantivalist has escaped only temporarily by a semantical trick. Suppose we grant that the term "space-time" does refer to an entity best represented by the metric space rather than the topological manifold. Still, that entity does *have* topological features. If we consider it *qua* only its topological features, we are considering *something*, something which by definition does not have metrical features essentially. I will give you the term: space-time: let us call this new entity "topo-space". Now if space-time is a substance, so is topo-space, and we can just repeat the argument for indeterminism.

I answer that it is true that one can inquire into the topology of a metric space, and determine what features it may have in virtue of that topology. Whatever conclusions one draws will equally apply to other metric spaces with the same topology even though their metrics may differ. The details of the metric may then *seem* to be irrelevant to the space-*qua*-topological. But this is not true if the entity only has its topology in virtue of its metric. For example, one may argue that the neighborhood structure is *derived* from the metrical features: sets of (physical) space-time points only form neighborhoods because of their spatio-temporal proximity relations. Thus the topology flows from the metric rather than the metric being imposed on the topological space. If one thinks of metric and manifold as form and matter, this is the ultimate case of the essential form making the matter what it is.

Nor is this response purely a philosopher's fantasy. Einstein expresses precisely such a view in a passage which Norton cites:

If we imagine the gravitational field, *i.e.* the functions g_{ik} , to be removed, there does not remain a space of the type (I) [Minkowski space-time], but absolutely *nothing*, and also no "topological space". For the functions g_{ik} describe not only the field, but at the same time also the topological and metrical structural properties of the manifold.

(Einstein 1917, p. 155.)

But whereas Norton, believing that the substantivalist must hold his view towards the topological space, takes this as evidence that Einstein rejected substantivalism, I contend that this is just the position the substantivalist must hold (see appendix).

None of this constitutes a positive argument for regarding space-time as a substance. Like statements about the average American family, space-time locutions might yet turn out to be misleading ways of talking about material objects and their relational properties. But it does not follow from the fact that the space-time metric physically *depends on* material fields (via the field equations) that it can be *logically reduced to* relations between those objects. Nor, as we have seen, need the substantivalist accept radical indeterminacy; he need only insist that mathematically the metric space, not the topological manifold, represents space-time. One must resist the temptation to read the ontological structure of mathematical objects into the objects that they represent. And, as Aristotle saw, one must be extremely sensitive to the relationship between substances and their essential properties if one is to avoid the absurdity of bare physical particulars, or bare physical manifolds. With Aristotle's help, we have been able to turn back one set of objections to the view that space-time is capable of existence independent of material bodies. A close analysis of the positive arguments for that view must await another time and place.³⁸

Appendix: Einstein and the Hole Argument

In [Norton 1987], John Norton argues that Einstein had discovered the hole argument by 1913. Norton contends that the argument was presented in four places (Einstein & Grossman 1913, Einstein & Grossman 1914, Einstein 1914a, and Einstein 1914b), but that it has since been misunderstood. According to him, Einstein's argument has been misread as employing only a passive re-co-ordinatization of the manifold and as incorrectly trading on the fact that the same tensor is expressed as having different components in different co-ordinate systems (Norton 1987, p. 164). One ought, he says, to read the transformation actively, as a diffeomorphism, rather than merely as a re-co-ordinatization. Thus, the hole argument was born over 70 years ago.

(38) I address these issues in "Buckets of Water and Waves of Space: Why Space-time Probably is a Substance", which was originally intended as, and may ultimately be, the third part of this paper. At this point, the final disposition of all of the parts as independent or conjoined awaits further clarification.

Although I agree with the general thrust of Norton's main conclusion, I do not believe that the texts will all bear the interpretation he gives them. First of all, I do not believe that all four passages are versions of the same argument. The first three, we are told, are essentially identical, and I shall so treat them (cf. *ibid.* p. 163). But the fourth has a different, more complex structure. It is only the fourth which obviously employs an active redistribution of the metric in the manifold, although Norton is correct in pointing out that the first three (hereafter known as the "first argument") turn upon more than the possibility of different co-ordinate expressions for a tensor at a given point. Let us begin with the first argument, and come to the second argument in turn.

I reproduce Norton's translation of the first argument:

If the reference system is chosen quite arbitrarily, then in general the g_{mn} cannot be completely determined by the T_{sn} [i.e. the stress-energy tensor density]. For, think of the T_{sn} and g_{mn} as given everywhere, and let all T_{sn} vanish in a region Φ of four dimensional space. I can now introduce a new reference system, which coincides completely with the original outside Φ , but is different to it inside Φ (without violation of continuity). One now relates everything to this new reference system, in which matter is represented by T'_{sn} and the gravitational field by g'_{mn} . Then it is certainly true that

$$T'_{sn} = T_{sn}$$

everywhere, but against this the equations

$$g'_{mn} = g_{mn}$$

will definitely not all be satisfied within Φ .^{*} The assertion follows from this.

If one wants a complete determination of the g_{mn} (gravitational field) by the T_{sn} (matter) to be possible, then this can only be achieved by a limitation on the choice of reference systems.

^{*} The equations are to be understood in such a way that each of the independent variables x'_n on the left hand side are to be given the same numerical values as the variables x_n on the right hand side.

(*Ibid.*, pp. 163-4, Einstein's italics and footnote.)

Norton goes on to claim that the only way to understand the footnote is to see Einstein as invoking a diffeomorphism rather than just a passive co-ordinate transformation.³⁹ But a much more straightforward reading is possible.

(39) I do not want to reproduce the algorithm which Norton takes this footnotes to indicate, because it is rather complex and, to me at least, not entirely clear. As far as I can tell, Norton is seeking an algorithm for comparing $g_{mn}(hp)$ [the original metric at hp expressed in terms of the original co-ordinate system] with $h^*g_{mn}(hp)$ [the carried along metric at hp expressed in the original co-ordinate system]. If so, his algorithm should apply to $g_{mn}(p)$ the transformation for $x'^n \rightarrow x^n$ at hp , rather than the transformation $x^n \rightarrow x'^n$ at p . Norton algorithm will probably compare $g_{mn}(hp)$ with $g_{m'n'}(p)$ (I say "probably" because he does not tell us in what co-ordinate system we are to express the original metric at p).

The argument that Einstein gives does employ a hole, but the first and last sentences make quite clear that the question at hand is not whether the entire state of the universe the outside the hole determines the state inside. Rather, the question is whether the stress-energy tensor density T_{sn} (representing matter) defined *everywhere* determines the metric g_{mn} everywhere. Einstein thinks that it must, probably as a sort of application of Mach's principle that inertial structure is determined entirely by the disposition of masses. The proposed criterion for an acceptable theory is the following: if you lay down a co-ordinate system and specify T_{ns} everywhere as a function of those co-ordinates, then the g_{mn} expressed as a function of those co-ordinates should be fixed by the laws of the theory. Einstein shows by a *reductio ad absurdum* that this requirement cannot be fulfilled unless one restricts the reference systems which are allowed.

The *reductio* runs as follows. Consider a distribution of matter T such that $T = 0$ within a region Φ . Consider two co-ordinatizations of the space-time x^n and x'^n which agree outside the hole but diverge within it. Then, since a zero tensor is expressed as having components equal to zero in all co-ordinatizations, the expression of T as a function of the x^n will be *functionally identical* to the expression of T in terms of the x'^n . That is, $T_{mn} = T'_{mn}$ *everywhere*, and "everywhere" can be taken in two senses. It is true that the co-ordinate components of T at any given point p in terms of the x co-ordinates are equal to the co-ordinate components of T in terms of x' co-ordinates *for that point p* $[(\forall p)(T_{mn}(p) = T'_{mn}(p))]$. But it is equally true that the co-ordinate components of T in terms of the x^n *at a point with co-ordinate values* $\langle N_1, N_2, N_3, N_4 \rangle$ *in the x co-ordinate system* is equal to the co-ordinate components of T in terms of the x'^n *at the point with the same numerical co-ordinate values in the x' co-ordinate system* $[(\forall N_1)(\forall N_2)(\forall N_3)(\forall N_4)(T_{mn}(\langle N_1, N_2, N_3, N_4 \rangle_x) = T'_{mn}(\langle N_1, N_2, N_3, N_4 \rangle_{x'}))]$.⁴⁰ The points referred to on either side of this equation are points which have a particular co-ordinate expression in each reference system, and since the systems diverge within the hole they will, in general, be different points of the manifold. It is this latter identity which, as his footnote illustrates, Einstein had in mind. It is this latter equation which correctly expresses the fact that the stress-energy tensor density has the very same functional form when expressed in

(40) In these equations, I have used terminology consistent with Einstein's, as I interpret him. " T'_{mn} " refers to the co-ordinate expression of T as a function of the x'^n . A more perspicuous terminology would be $T_{m'n'}$, which would make evident that the prime indicates a change of co-ordinates, not a change in the tensor itself. In Einstein's second argument he had to introduce some such more perspicuous notation, indicative of a change in the mathematical operation being performed.

terms of the x^n as it has when expressed in terms of the x'^n . But now an application of the Machian principle cited above yields that if the theory appropriately allows the T_{mn} to determine the g_{mn} , then the gravitational metric must *also* have the same functional form relative to each co-ordinatization, $g_{mn} = g'_{mn}$. This statement again is made for points with equal co-ordinate values, i.e., for different points in the manifold. But this clearly cannot be the case, since different points within the hole may have, e.g., metrics with different (scalar) curvatures: the gravitational field cannot generally take the same functional form when expressed in terms of the two co-ordinate systems.

Einstein's footnote makes clear that he is comparing the g_{mn} and the g'_{mn} at different points. Since the points are to have the same numerical co-ordinate values but are given in two different reference frames, they must in general be different points. In a scientific world in which changes of reference frame were common coin and diffeomorphisms not, the equations could not have been read otherwise. The argument is crisp and accurate, and it does indeed demonstrate that generally co-variant field equations cannot satisfy the Machian criterion stated above. This failure does not *simply* arise from gauge invariance (*pace* Pais 1982, pp. 221-222), nor is the point identical with the hole dilemma of Earman and Norton. It just is a fact that fixing T does not fix g in general relativity. There are, for example, solutions of the vacuum field equations with and without gravitational waves, and hence space-times with $T = 0$ everywhere which are not isometries. The criterion that Einstein states at the beginning of the passage cannot be satisfied by the general theory.

The first argument, then, makes perfect sense in light of the Machian principle enunciated in the first sentence. No diffeomorphism need be invoked in understanding his footnote, only a re-co-ordinatization. Further, we later find Einstein holding to such a criterion and criticizing the equations of 1915 in its light. In 1917 Einstein finds fault with his own earlier analysis of planetary motion because it implies that "the inertia [of a body] is *influenced* by matter (at finite distances) but *not determined* by it. If only a single mass point existed it would have inertia... [but] in a consistent relativity theory there cannot be inertia relative to 'space' but only inertia of masses relative to each other" (Einstein's italics. Cited in Pais 1983 p. 286). And in 1918 he states as a fundamental principle that "The G-field is *without remainder* ('restlos') determined by the masses of bodies" (cited in Pais p. 287). With the passage of time Einstein came to see that this Machian demand could not be met, and so he eventually abandoned it (cf. *ibid.* pp. 281-288).

Einstein's first argument does not employ an active transformation like Norton's diffeomorphism. Furthermore, it is not as general as his

since it requires that the stress-energy tensor density be identically zero within the hole, so that its co-ordinate representation under the re-co-ordinatization remains the same. His second argument, however, clearly does employ the notion of an active transformation. The extra complexity of this argument is reflected in the additional technical machinery he is required to use: whereas in the first argument he could unambiguously refer to g_{mn} and g'_{mn} , since one metric was at issue, albeit described in two reference frames, in the second argument he needs " $G(x)$ " to refer to the original metric expressed in the original frame, " $G'(x')$ " to refer to the original metric as expressed in the new co-ordinate system,⁴¹ and $G'(x)$ to refer to the metric with the same functional form as $G'(x')$, but with the arguments now being the co-ordinates of the first system (cf. Norton 1987, p. 167). Thus although I don't think the texts support Norton's active reading of the first argument, there clearly is an active transformation in the second. It is not exactly the hole argument of Norton and Earman, but it is similar.

What did Einstein make of this argument? Originally, he inferred that general co-variance must be sacrificed. But he later came to accept, even embrace, that requirement. What had to be given up to remove the fangs from the hole argument?

Norton asserts that at first Einstein could only resolve the dilemma by adopting non-realism about space-time, by which he means the view that the English term "space-time" has "no referent in the physical world" (*ibid.* p. 177). Arthur Fine evidently takes a similar view (cf. Fine 1984, pp. 91-2). Norton does think this inference of Einstein's to be unwarranted (Norton 1987, pp. 176-83), but accepts it as a temporary error on the way to a weakened "anti-substantialist" view of space-time (which we shall take up presently). Both Norton and Fine can cite some passages from 1915-1916 in which Einstein appears to take up this uncompromising position: "That this requirement of general co-variance, which takes away from space and time the last remnant of physical objectivity, is a natural one, will be seen from the following reflexion..." (Einstein 1916, p. 117); "The essential thing is: as long as the drawing paper, i.e. 'space', has no reality, then there is no difference at all between the two figures..." (cited in Norton 1987, p. 174). If we take these quotations in isolation, and ascribe to Einstein some understanding of referential semantics, Norton's claim appears to follow.

(41) It is notable how Einstein uses his primes here, for it reflects the way he thought about the problem. To someone schooled in co-ordinate free presentations, $G(x')$ would be the natural way to denote the original metric as expressed in the new co-ordinate system, for the *metric* (G) is the same, only the reference frame has changed. But what was important to Einstein was the *functional form* of the metric expressed in terms of the co-ordinatization. Since that functional form changes under re-co-ordinatization, the same metric becomes $G'(x')$ rather than $G(x')$.

But a close examination of the context reveals that the non-realist interpretation of these passages does not capture Einstein's meaning. For Einstein consistently interchanges assertions of the form "space and time are not physically real" with assertions of the form "spatial and temporal *co-ordinates* have no physical significance", and it is clearly the *taller* claim which concerns him. Consider the beginning of the section on general co-variance from [Einstein 1916]:

In classical mechanics, as well as in the special theory of relativity, the co-ordinates of space and time have a direct physical meaning. To say that a point-event has the X_1 co-ordinate x_1 means that the projection of the point-event on the axis of X_1 , determined by rigid rods and in accordance with the rules of Euclidean geometry, is obtained by measuring off a given rod (the unit of length) x_1 times from the origin of co-ordinates along the axis of X_1 . To say that a point-event has the X_4 co-ordinate $x_4 = t$, means that a standard clock, made to measure time in a definite unit period, and which is stationary relative to the co-ordinates and practically coincident in space with the point-event, will have measured off $x_4 = t$ periods at the occurrence of the event.

This view of space and time has always been in the minds of physicists, even if, as a rule, they have been unconscious of it...

(P. 115, my italics.)

This "view of space and time" clearly has not to do with the *ontological status* of space-time but with the *operational significance* of spatio-temporal co-ordinates.⁴² In Newtonian physics and in the special theory of relativity, once you associate an inertial frame with a physical body as its origin and fix some co-ordinate axes and a zero time, the assertion that an event will occur at, say, $\langle 1, 3, 0, 7 \rangle$ has *physical significance*. It tells you about the behavior of clocks and rigid rods connecting the body at the origin with the event. And co-ordinate differences between points have a similar meaning. Einstein's point in denying physical reality to space and time in a generally co-variant theory is that no such operations are associated with co-ordinate values in such a theory. The most exhaustive information about the origin and axes of a reference frame in a generally co-variant theory will impart no information about how to physically locate particular co-ordinatized points. Co-ordinate differences also obviously will have no general physical significance.

Perhaps the physicist who Einstein speaks of as unconsciously holding this view of co-ordinatizations was himself several years earlier. That would in part explain why, in the first argument, he thought it significant that points with the *same co-ordinate value* would have different metrics. Since the axes of the reference frames could die

(42) Of course, given a sufficiently positivist outlook, questions of ontology or reality may simply reduce to questions of operational significance, and the question concerning us, whether space-time is a substance or not, cannot even be formulated.

entirely outside of the hole, if some operational significance akin to that in the special theory could be ascribed to the co-ordinates here, general covariance would have to be curtailed. Once one shakes off the notion that co-ordinates have any operational meaning, a more complicated argument, such as the second one, is needed.

Einstein's concern with the operational significance of co-ordinates rather than the ontological status of space-time is also evident in the letter to Ehrenfest from which the second of the above "non-realist" quotations was taken. Earlier in the letter he writes "Your difficulty has its root in the fact that you instinctively treat the reference system as something 'real'" (Norton 1987, p. 173). But the "imaginary" character of the *reference system*, in this sense, need not impugn the reality of the object to which the system is attached. Differences in Dewey decimal numbers signify no real physical property, but that need not make us non-realists about the contents of the public library. If Einstein ever thought in terms of substances, non-substances, and non-existent entities, these passages would not commit him to non-realism about space-time itself.

Co-ordinate values in Newtonian theory and in the special theory can have a physical significance because what is co-ordinatized is the *metric space*, and because only a limited number of reference systems are allowed. These are two quite different points. Certain particular co-ordinatizations of these metric spaces yield especially simple co-ordinate expressions for the physical laws because these space-times exhibit a perfect isotropy and homogeneity. Curvilinear co-ordinate systems can be put down on these spaces, and the laws expressed in terms of them, but then the physical significance of the co-ordinate values becomes much more complicated, and no general significance can be ascribed to co-ordinate differences. Still, given any co-ordinate system laid down on a *metric space*, whether in special or general relativity, physical statements of the form "a clock moving from point *p* to point *q* along path *l* will register 5 ticks" can be made.

Once one moves to co-ordinates on the bare manifold, however, *no physical significance, no matter how complex, can be associated with the reference system*. Points in the bare manifold are no particular distance apart, stand in no causal relations, are not intrinsically connected by any physical process. Thus, if, in one way or another, physical processes are used to define reference systems, we find that *one can only meaningfully co-ordinatize space-time as a metric space*. This is one way of stating the hole dilemma.

Given Einstein's equation of the reality of space-time with the physical significance of frames of reference, it is not surprising that he should come to regard space-time as real only if it is invested with a metric. This is the position that Norton dubs "anti-realism", and is best captured by the following quotation :

There can be no space [space-time] nor any part of space without gravitational potentials; for these confer upon space its metrical qualities, without which it cannot be imagined at all. The existence of the gravitational field is inseparably bound up with the existence of space.
(Cited in Norton 1987, p. 181.)

If this is taken to be the core of Einstein's position, then our metaphysical battles reduce to a mere squabble over terminology. Norton *calls* this position anti-substantialist, but I hope to have shown that it is just what any red-blooded substantialist, from Newton on, would insist upon! Space-time must be regarded as essentially a metric space, not a topological space which has its geometrical properties only accidentally. The real question is whether such a metrical space with intrinsic inertial structure must be considered to be capable of existing independently of material bodies (represented by the stress-energy tensor), or whether it can be analyzed away as a *façon de parler* about the relations that obtain between bodies. This is the issue which divided Newton on the one hand from Leibniz and Mach on the other, the issue which impelled Einstein to his original insistence that the stress-energy tensor *completely* determine the gravitational field. Einstein grew away from this demand, and in so doing abandoned the relationalist camp. I hope to have shown that Einstein was quite correct in his pronouncement, a year before his death, that "one should no longer speak of Mach's principle at all" (cited in Pais 1982, p. 288). If one accepts the general theory of relativity as giving a literally correct picture of the physical world, one must stand with the Newtonian tradition and regard space-time as a substance.

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MAN AND COSMOS IN ARISTOTLE: Metaphysics A and the Biological Works¹

ANTHONY PREUS

INTRODUCTION

In what sense is Aristotle's biology continuous with the twentieth century science of biology, and in what sense is it discontinuous, a separate enterprise? Critics of Aristotle's biological works are fond of citing his various "errors": the notions that the heart has just three chambers,² that women have fewer teeth³ and fewer sutures in their skulls,⁴ for example. But all such critiques start by assuming that Aristotle was engaged in an enterprise not dissimilar from modern natural history. In fact Aristotle reports so many *accurate* observations which *could* be part of a modern natural history, that his "errors," from this point of view, would not lead us to suspect that his enterprise is something quite different and alien from anything which may be found in modern science.

Another group of supposed "errors" includes his claim that the seat of the soul is in the heart (rather than in the brain), that it is the blood

(1) This paper was presented at the conference on Aristotle's Metaphysics and Biology at Ile de l'Oleron in June/July 1987. Part of my preparation was aimed at commenting on a potential paper by Michel Roussel; I have profited by reading some of his essays: "Physique et biologie dans la *Génération des Animaux* d'Aristote", *Revue des Études Grecques* XCIII (1980) 42-71"; Éther et chaleur dans l'embryologie aristotélicienne, influences archaïques", in *Mélanges Lebel*, pp. 157-160, Quebec 1980, and "La semence de feu" in *Mélanges Gareau*, pp. 57-64. I thank several participants in the conference for calling attention to some of my errors; Allan Gotthelf deserves special thanks, though I have no doubt still not met all of his objections.

(2) *PA* 111.4, 666b21, e.g.

(3) *HA* 11.3, 501b20.

(4) *PA* 11.7, 653b1.

vessels which carry information from the sense organs to the heart and back to the organs of local movement,⁵ apparently by means of connate *pneuma*,⁶ that the female provides the matter and the male the form, in sexual generation,⁷ and that male and female embryos develop in the uterus at different rates.⁸ In these cases, it is pretty obvious that the claims are "theory-laden", and that Aristotle's statements indicate the consequences of a theoretical stance which is radically but recognizably different from our own. Those who believe in "scientific revolutions" and "epistemological breaks" between Aristotle and us can very well point to these passages, these theoretical trends, as evidence supporting their hypothesis that Aristotle's "science" is fundamentally different from our own, perhaps in ways that do not automatically entail "progress" from Aristotle's day to ours. Still, we can compare the theoretical structure of Aristotle's explanations and in many cases find that, according to the philosophical canons of our science at least, Aristotle's explanations appear to "fail" in comparison with those offered by twentieth century investigators.

There are some passages which are much more "alien" to most of us as we read the biological works; we cannot read these passages as either "successes" or "failures" on our terms; their author is playing with an entirely different deck than we are. Some passages which strike me, at least, that way are the "cosmological" passages; the *Generation of Animals* has several especially striking examples of such passages. It is impossible, I think, to interpret these passages from a standpoint taken within the biological texts alone; one must look at them from the wider perspective of Aristotle's general theory of the relationship between life, especially human life, and the cosmos in general. We find in Aristotle's bio-cosmology (if I may call it that) an apparent anthropocentrism which has become almost incomprehensible to us, a theory of "heat" which we are tempted to call "mystical" (when we really mean "mysterious"), and an assumption of the relationship between mind and the universe which survives for us only as a dimly recognized religious dogma, not as anything which we can accept as cognitively significant.

We may classify the passages in question in a variety of ways; for my present purposes I will discuss them according to the following schema:

1. "Orientation." Human erect stature in alignment with the cosmos.

(5) *PA* III.4, 666a11 *et al.*

(6) *MA* 10, 703a12.

(7) *GA* I.20, 729a10 *et passim*.

(8) *HA* VII.3, 583b3.

2. "*Pneuma* and *ailher*" (especially *GA* II.3).
3. Biological and Cosmic Periods (especially *GA* IV.10).

Valuable clues to the understanding of these passages in the biological books may be gained by reading them in the light of *Metaphysics* A; I begin by calling attention to two places in that book:

Our forefathers in the most remote ages have handed down to us their posterity a tradition, in the form of a myth, that these [celestial] entities are gods and the divine encloses the whole of nature... We must regard this as an inspired utterance, and reflect that, while probably each art and science has often been developed as far as possible and has again perished, these opinions have been preserved like relics until the present.⁹

We must consider also in which of two ways the nature of the universe contains the good or the highest good, whether as something separate and by itself, or as the order of the parts. Probably in both ways, as an army does. For the good is found both in the order and in the leader, and more in the latter; for he does not depend on the order but it depends on him. And all things are ordered together somehow, but not all alike, — both fishes and fowls and plants; and the world is not such that one thing has nothing to do with another, but they are connected. For all are ordered together as to one end.¹⁰

I take these passages as summaries and indications of the Aristotle's cosmological theories as contained not only in *Metaphysics* A but also in the *Physics*, *de Caelo*, and *Meleorologica*.

1) "ORIENTATION"

The idea of cosmic directions (up and down, right and left, front and back) is more prominent in the *Physics* (especially IV.1) and *de Caelo* than in *Metaphysics* A, but the results of those inquiries seem presupposed by the argument in A. It may be too that the idea of cosmic directions is a relatively "primitive" element in Aristotle's thought; at any rate passages referring to the notion of cosmic orientation are the most pervasive sort of "cosmic" passages in Aristotle's biology. They occur in all of the biological works, as well as elsewhere.

a) In the *History of Animals* I.15 the upright position of man is simply stated to be "natural" with respect to the arrangement of the universe:

In man, above all other animals, the upper and lower parts are arranged in accordance with their natural positions; for in him, upper and

(9) *Metaph.* A. 8, 1074b1-4, 9-12, Ross/Barnes tr., changing "substance" to "entity".

(10) *Metaph.* A. 10, 1075b1 1-19, Ross/Barnes tr. The continuation of the passage is equally interesting.

lower are the same as in the universe as a whole. In like manner the parts in front, behind, right and left, are in accordance with nature. But in regard to other animals, in some cases these distinctions do not exist, and in others they do so, but in a vague way. For instance, the head with all animals is up and above in respect to their bodies; but man alone, as has been said, has, in maturity, this part uppermost in respect to the universe.¹¹

b) Elsewhere, several explanations are given for the "naturalness" of man's erect posture. One such explanation, fairly frequent in the biological books, is that "up" and "food intake" have a naturally close relationship, and that "down" and "residue output" also have a naturally close relationship. This point is made particularly clearly in *IA* 4, where up and down, front and back, right and left are said to define living beings. Up and down are universal, characterising plants as well:

They are distinguished functionally, not just by position in relation to earth and sky — for there from where the distribution of food and growth starts in each sort of thing, is up; the part at which it finally ends, is down. The one is the origin, the other the finish; up is the origin. Yet it might seem that down is more special in plants; for in them up and down do not have the same position as in animals. They do not have the same relation to the universe, but they have the same function. For the roots are the "up" in plants; from them the food is distributed to the growing parts, and they get it with them as animals do with mouths.¹²

The passage continues to discuss the functions of front and back, right and left in animals, and makes clear that in human beings, up is more clearly up, front is more clearly front, and right is more clearly right, than in any other animal. Now of course one might easily claim that the import of this whole line of discussion is simply to assert that

(11) *HA* I.15, 494a27-b1, Thompson/Barnes tr. In *de Caelo* II.2, 284b5 ff, Aristotle considers the Pythagorean hypothesis that right and left have a cosmic significance; referring to his discussion of the movements of animals (clearly a reference to *IA* 4-5, part of which we quote next in the text), Aristotle first distinguishes the coordinates in terms of length, breadth, and depth (284b24), then says:

Or again we may connect them with the various movements, taking principle to mean that part, in a thing capable of movement, from which movement first begins. Growth starts from above, locomotion from the right, sense-movement from in front. (284b25-29)

The conclusion toward which Aristotle is aiming is that since "the heaven is animate and possesses a principle of movement, clearly the heaven must also exhibit the above and below, right and left" (285a29).

(12) *IA* 4, 705a28-b9, tr. Preus, 1981. Cf. the *Cael.* statement (quoted in the previous note) that "growth starts from above." Other passages which follow the same line of thought include *PA* II.10, 656a11-13; and *Juv* I, 468a10, which makes even more of the contrast between man and plants. Cf. *PA* III.10, 672b22-24, for "up as origin." For the analogy of mouth and root, see also *de An.* II.1, 412b3; 4, 416a4; *Long* 6, 467b2; *PA* IV.7, 683b20; 10, 686b35; *GA* II.6, 741b33-37. See also W. K. Kraak, "Aristote est-il toujours resté fidèle à sa conception que la plante se tient la tête en bas?" *Mnemosyne* 3.X (1942) 251-262.

human beings are paradigmatic animals, and that all other animals fall short of the perfection of human nature to a greater or lesser extent.¹³ But that is not exactly what Aristotle says; he does not say that man's way of being in the world determines human perceptions of the structure of the universe. Rather, he implies that the orientation of the coordinates (I am tempted to say "Cartesian" coordinates) is independently discoverable, and that man is discoverably more in line with the universal coordinates than is any other animal.

Michael's commentary on this passage makes even more obvious, without resolving, the conceptual problem it contains: he suggests that "up" is *defined* functionally, in terms of food intake, but if that is so, then how can we say that the "up" in the *universe* is really up at all, since Aristotle's universe as a whole does not take in food or excrete residues.¹⁴ What, then, does "up" have to do with food? Is it that the residue of food is primarily the earthy part, that we extract from our food primarily the fire, secondarily the air, and leave most of the heavier elements? Thus the residues proceed "naturally" toward their natural places, downward. On this showing, plants would be naturally upside down, so to speak, because they are composed of a higher proportion of earth, and their "residue" (Aristotle means the fruits!) consequently concentrate the lighter elements. And we gain what we need by eating the "residues" of plants.

Thus I think that the relationship between "up" and the function of nutrition is one of "accidental necessity" in Aristotle's scheme of things: the process of digestion (especially in man) is one of extracting primarily the lighter, warmer elements of food, leaving the colder, heavier elements. But that means that the natural direction of movement of the food will be progressively more and more "down", so the intake is naturally up, excretion naturally down.

c) Another explanation of man's erect stature turns directly on the relationship between up and heat. This sort of argument appears particularly in the *Parts of Animals*:

Of all animals, man has the largest brain in proportion to his size; and it is larger in men than in women. This is because the region of the heart and of the lung is hotter and richer in blood. This again explains why man, alone of animals, stands erect. For the heat, overcoming any opposite inclination, makes growth take its own line of direction, which is from the centre of the body upwards.¹⁵

(13) This is apparently how Simon Byl, for example, takes this sort of passage, *Recherches sur les grands traités biologiques d'Aristote: sources écrites et préjugés*, Bruxelles, 1975, p. 305.

(14) We recall that according to Aristotle the Pythagorean universe consumes void (*Physics* IV.6, 213b23 ff). Plato's universe eats its own excrement (*Timaeus* 33c).

(15) *PA* II.7, 653a27-32; Ogle/Barnes. The relationship between heat and man's erect posture is mentioned in passing by Roussel, *REG* 1980, p. 45. *PA* II.7 is also where

The erect stature of man is again explained in terms of the natural places of the elemental powers—heat “belongs” up, cold down. Another passage, in *PA* III.6, confirms the relationship between the “food” explanation and the “heat” explanation of man’s erect stature: “Heat promotes growth, and abundance of blood is an indication of heat. Heat, again, tends to make the body erect; and thus it is that man is the most erect of animals, and the vivipara more erect than other quadrupeds.”¹⁶

One of my students called this the “air head” theory of man’s erect stature; if you try to imagine the mechanics of Aristotle’s explanation, it does seem (at least at first glance) to require that human beings have heads full of hot air, quadrupeds less so, and snakes least. How else could heat lift up the human race? One might say that the student’s response results from the imposition of our mechanics on Aristotle’s science; that’s true, but does not solve the problem. How does Aristotle’s system permit heat to lift up this all too solid flesh without generating containers of hot gasses, hot air balloons?

I submit that the differences in “heat” between man and the other animals are not, from Aristotle’s point of view, simply matters of the *quantity* of heat, either in terms of temperature or in terms of kilocalories. We need to remember that the very notion of *temperature* in the sense of a *measured* scale is a modern idea; Aristotle did not have and did not envisage a thermometer. Furthermore, the idea of measuring a *quantity* of heat, in the sense of a calorie or in the sense of a British Thermal Unit, is intensely dependent upon prior measurements: those of the temperature and the volume of specific materials, and their capacity to change the temperature of other materials.

We need to recognize that when Aristotle says that the “region of the heart and lung is hotter” in human beings, that word “hotter” may be a *qualitative* rather than a *quantitative* judgement. I rather imagine that his theory is not refuted by simply pointing out that birds run a higher normal temperature than human beings.¹⁷ But if we understand some of these seemingly quantitative judgements as rather qualitative in character, then they become both consistent with and explanatory of

Aristotle says that males have more sutures in their skull than females, because their brain is larger, demanding more ventilation. If the brain is too moist, it will freeze the blood, if it is too dry, it will fail to cool it, which causes “disease, madness, and death.” For other explanations of madness in Aristotle, see my “Aristotle on Healthy and Sick Souls,” *The Monist* 69.3 (July, 1986) 416-433.

(16) *PA* III.6, 669b5-6, Ogle/Barnes.

(17) Aristotle might accept the idea that birds have a higher temperature as an explanation of why they can fly; he might more readily accept a hot-air theory than a higher metabolism rate theory of bird flight.

the rather obscure explicit qualitative passages; I have in mind particularly *GA* II.3, 736b30 ff., discussed below.

d) A rather different mode of explanation of man’s erect stature relates it to human thought (a notion notably absent in the passages cited above), and consequently to man’s “divine nature.” This idea appears especially in *Parts of Animals* IV:

For of all animals man alone stands erect, in accordance with his god-like nature and substance. For it is the function of the god-like to think and to be wise; and no easy task were this under the burden of a heavy body, pressing down from above and obstructing by its weight the motions of the intellect and of the general sense.¹⁸

A train of thought of this kind is, I suppose, comprehensible but essentially alien for us. We can understand it, in a way, because we are familiar with an ascetic tradition in which fasting and slenderness are associated with mystical intellection, but we find this sort of argument alien because it puts the association between lightness and intellection into a biological rather than a religious context.¹⁹ In order to interpret the theory of mind in this sort of passage we would have to turn not only to *Metaphysics* A but also to *De Anima* III and *Nicomachean Ethics* X. For now, an examination of the cosmic importance of mind would lead us too far astray; we can, however, notice that there is a clear enough relationship between this explanation and the previous one, the one I called the “air head” theory. That is to say, this passage clearly enough shows that the human capacity of mind is related significantly to the quality of the heat in human beings; lightness is associated on the one hand with high-quality heat, and on the other with high-quality intellection. We may say that from a teleological point of view, human thought requires a physical base which has plenty of tempered high-quality heat; the presence of that sort of heat causes the body to be lifted up and to walk around in an erect position. Consequently the body is aligned with the vertical axis of the universe, the best relationship with the universe which a body can manage and still have its feet resting on the ground.

(18) *PA* IV.10, 686b26-28, tr. Ogle/Barnes. 689b11: consequently all other animals are “dwarflike”. 690a28: consequently also man has the largest foot in proportion to the size of the body. Byl (*op. cit.*, p. 305) remarks that even though Aristotle was unacquainted with the kangaroo, he did know the rabbit and hare. We may reply that one may easily take the “paws” (phalanges) of rabbits and hares as their feet, and those are not large. If we trace out homologous bone to homologous bone, then the “heel” (tarsus) of the horse is quite a way up the back leg; the horse runs essentially on one toe on each foot. Antelopes have proportionately the longest metatarsus bones of any animal, including the kangaroo. See Preus (1981) p. 40.

(19) Although we can all think of more or less ascetic philosophers — Kant comes to mind, we are also familiar with some who were heavy enough to disprove what appears to be Aristotle’s generalization in this passage — Hume would be a good example.

e) An explanation of man's erect posture which Aristotle does *not* offer is the one which Galen gives, that it frees the hands for their multiple functions for the human being.²⁰ This sort of explanation would, I think, smack of Anaxagoras' notion, refuted in *PA* IV.10, that man is the most intelligent of animals because he has hands; rather, man has hands because he is the most intelligent animal. In fact Galen comes close to falling into the Anaxagorean error himself.²¹ Nor does Aristotle recognize Xenophon's explanation, that we can thus see objects above us more easily, and thus avoid danger.²² No, man has hands because he is most intelligent, and being most intelligent causes an erect stature; nature makes use of the erect stature to provide this tool of tools.²³

Assuredly this is not biological functionalism; rather, this way of thinking belongs to another mode of thought entirely, more in tune with the cosmic teleology of *Metaphysics* A than with anything we readily recognize as a scientific appreciation of the world.

Before I get in too deep, let us look at two other relationships between biological and cosmic reality, the analogy of *pneuma* and *aither* and the relationship between cosmic and biological periods.

2) PNEUMA AND AITHER

Explicit reliance on the notion of *aither* is relatively rare in the Aristotelian corpus. Neither *Metaphysics* A nor *GA* II.3 uses the word *aither*; rather the one talks of "the body (*σῶμα*) which moves in a circle" (1073a31) and the other, mentioning a *σῶμα*, refers to τὸ τῶν ἄστρον στοιχείον. Even in the *De Caelo* Aristotle usually uses a descriptive phrase rather than the word *aither*.²⁴ Still, there is some justification for using word *aither* in this context.

In the beginning of the *de Caelo*, Aristotle argues that to explain the motion of the universe we must posit that there be some "body" which

(20) Galen, *de Usu Partium* III.3, May 160, for example.

(21) *Idem* III.1, May 154.

(22) Xenophon *Mem* I.4.11, reference thanks to Byl, p. 128.

(23) *PA* IV.10, 687a6ff.

(24) *De Caelo* I.2, 269a31: τις οὐσία σώματος ἄλλη παρὰ τὰς ἐνταῦθα συστάσεις. 269b14: τι παρὰ τὰ σώματα τὰ δῦρο καὶ περὶ ἡμᾶς ἕτερον κειρωρισμένον, τοσοῦτ' αὖ τιμωτέρων ἔχον τὴν φύσιν ὥσπερ ἀφίστηκε τῶν ἐνταῦθα πλεόν. I.3, 270b3: τὸ πρῶτον τῶν σωμάτων (not πέμπτον σώμα). For a discussion of the development of Aristotle's theory of this body, see David Iahm, "The Fifth Element in Aristotle's *de Philosophia*: A Critical Reexamination", in Anton and Preus, eds., *Essays in Greek Philosophy II*, Albany 1983, pp. 404-428. See also J. Thorp in *Phoenix* XXXVI (1982) 104-123 for an interesting discussion of how *aither* lights up, according to Aristotle.

naturally moves with a circular motion, a body distinct from fire (*pace* Anaxagoras); that body will be ungenerated, undestroyed, eternal and divine. Everyone agrees that the immortal is divine, and the heavens are observed not to change at all.

The name, too, of that body seems to have been handed down right to our own day from our distant ancestors who conceived of it in the fashion which we have been expressing. The same ideas, one must believe, recur in men's minds not once or twice but again and again. And so, implying that the primary body is something else beyond earth, fire, air, and water, they gave the highest place the name of *aither*, derived from the fact that it "runs always" for an eternity of time.²⁵

The parallel between this passage and the first of the two I quoted at the beginning from *Metaphysics* A is obvious; only the name "*aither*" has been omitted from the *Metaphysics* passage. Aristotle has persuaded himself that the idea of the divinity of the heavens is one which persistently recurs throughout human history, and that it is one of the few leading ideas which regularly survives the periodic catastrophes to which human history is subject. Occasionally Aristotle uses the word *aither* as a convenient shorthand for the idea that there is some *σῶμα* or *ousia* which is superior to all the terrestrial elements, moves in a circle, and is identified with the heavenly spheres.

A great deal can (and has²⁶) been said about the role of *pneuma* in Aristotle's explanation of life and soul in the biological works. This is not the place to review all of that; I only want to say a few things about *Generation of Animals* II.3, 736b30 ff:

...It remains that mind alone come in additionally from outside and alone be divine; for bodily activity has no share in its activity. Now the power of every soul seems to share in a body different from and more divine than the so-called elements; but as souls differ in value and lack of value, so too this sort of nature differs. All have in their semen that which causes it to be productive; I mean what is called "heat". This is not fire nor any such power, but it is the *pneuma* wrapped up in the semen and in the foam-like, more precisely* the nature in the *pneuma*, which is analogous to the element of the stars. Hence, whereas fire generates no animal and we do not find any living thing forming in either solids or liquids under the influence of fire, the heat of the sun and that of animals does generate them. Not only is this true of the heat that works through the semen, but whatever other residue of the animal nature there may be, this also has still a vital principle in it. From such considerations it is clear that the heat in animals neither is fire nor derives its origin from fire.²⁷

(25) *De Caelo* I.3, 270b16-23, tr. Stocks/Barnes, with minor revision. Cf., e.g., *Cael.* II.7, which says that the stars are composed of that element.

(26) See especially M. Nussbaum, *Aristotle's De Motu Animalium*, Princeton 1987, pp. 143-164, with her citations; G. Verbeke, "Doctrine du pneuma et entéléchisme chez Aristote", in G.E.R. Lloyd and G.E.L. Owen, *Aristotle on Mind and the Senses*, Cambridge 1978, pp. 191-214.

(27) *GA* II.3, 736b30-737a6, my translation, partly relying on Platt/Barnes, partly on Balme. See D.M. Balme, *Aristotle's De Partibus Animalium I and De Generatione*

One quick comment: this discussion of *pneuma* occurs immediately after a striking statement of the separate origin of mind. Although the explanation in the passage is not developed simply in order to account for the coming into being of mind in the human soul, it is likely to be relevant for such an account.²⁸

In this passage it is assumed that there are (at least) two kinds of heat, the heat of fire and vital heat; we may conclude from the passage that (*vital*) heat causes animal generation,²⁹ and that (*vital*) heat occurs notably in *pneuma*. (The "body" (σώματος) at 736b30 has to be *pneuma*.) Because they contain (animal) *pneuma*, various animal residues also contain vital heat. Aristotle has in mind, for example, the feces within which many insects and so on are supposedly generated (in so-called spontaneous generation).³⁰

This *pneuma* contains some "nature" (the heat?) which is "analogous to the element of the stars," i.e. *aither*. How should we understand the word ἀνάλογον here? Generally in Aristotle, one thing is an ἀνάλογον of another if those things are different in *genos* but similar in function. For example, Aristotle often talks about "the heart or its analogue," "blood or its analogue," meaning the part which fulfills the functions of the heart or the blood in animals which do not have (proper) hearts or blood. Typically, one may construct an analogy of the form: blood is to the animals with blood as the analogue is to animals with the analogue of blood. But what is the implied analogy between *pneuma* and *aither*? "The nature in the *pneuma*" is to X as "the element of the stars" is to Y. Both the "X" and the "Y" are problematic. A simple way of solving the equation would be to interpret it thus: "the heat in the *pneuma* is to the *pneuma* as the heat in the *aither* is to the *aither*." That would mean that there are (at least) three sorts of heat: fiery, pneumatic, and aitherial.

In (1975) I suggested that there is some ground for supposing that *aither* permeates the universe,³¹ according to Aristotle, and consequently

Animalium I (with passages from II.1-3), Oxford, 1972, especially his note, pp. 158-165. At*, the translation follows Paul Moraux, "A propos du ΝΟΘΣ ΘΥΡΑΘΕΝ chez Aristote," *Autour d'Aristote*, Louvain 1955, p. 255; see Balme p. 163. Roussel discusses this passage (briefly) in *REG* 1980, pp. 68-69.

(28) Balme's note to the passage gives a plausible enough interpretation; I will not duplicate it here.

(29) See Balme on this, as well as Nussbaum.

(30) *HA* V.19, 551a4ff: "...others grow in decaying mud or dung; others in timber, green or dry; some in the hair of animals; some in the flesh of animals; some in excrements: and some from excrement after it has been voided, and some from excrement yet within the living animal, like the helminthes or intestinal worms."

(31) A. Preus, *Science and Philosophy in Aristotle's Biological Works*, Hildesheim 1975, pp. 86-89. Nussbaum *MA* p. 161-162, arguing that an identification of *pneuma* with *aither* will not solve the problem of purposive movement in *MA* 10, claims to be in

might be present in the psychic *pneuma*. Peck remarks³² that *de Anima* II.7, 418b6-10 states that the transparency of air, water, and various solids is due to the presence in them of the "same nature as also in the eternal bodies above. Light is the activity of this transparent qua transparent." One might imagine that Aristotle thinks that *aither* is present in water in that water is transparent, and that *pneuma* is present in water in that it is warmed by the sun or other heavenly body. What is the relationship between the *light* of the sun and the *heat* of the sun? That may be one way of characterizing the relationship between the *aither* in the sea and the *pneuma* in the sea.³³

In *Generation of Animals* III.11 we get a somewhat different account of "spontaneous" generation:

Animals and plants are generated in earth and in water because in earth water is present, in water *pneuma* is present, and in all *pneuma* psychic heat is present, so that in a way all things are full of soul.³⁴

The pervasiveness of *pneuma* and consequently of vital heat (and, in a way, soul) tends in a direction rather away from the hylomorphism of *de Anima*: there, Aristotle criticized the idea that "the soul pervades the whole universe, whence perhaps came Thales' view that everything is full of gods," on the ground that describing "fire or air as living creatures is highly irrational, and yet to refuse to call them living creatures, if there is a soul in them, is absurd."³⁵ Indeed, it seems to me that the argument in *de An.* I.5 is inconsistent with both *GA* II.3 and III.11, since in both *GA* passages Aristotle is essentially asserting that soul is present in hot air (*pneuma*). To be sure, in *GA* II.3, generative power is limited to *animal* heat, which might be interpreted as a (separated) organ of the animal, a capacity of generating which belongs ultimately to the organic unity of the generating animal. But *GA* III.11 cannot be interpreted in that way, since the *pneuma* in sea water is not at all said to have an animal origin. There may be two sorts of heat at work in III.11: the vital heat present in all air (762a20) is

agreement with Balme, Moraux, and Rüsche in rejecting "any facile identification of *pneuma* with *aither*" on the basis of our passage. I would now say that I am not attempting to "identify" *pneuma* with *aither*, but rather to show that they are closely related in Aristotle's mind in this passage, and perhaps elsewhere.

(32) A. L. Peck, *Aristotle: Generation of Animals* (Loeb), note to 737a1, and see also his appendices.

(33) Thorp's comments (*Phoenix* 1982) on celestial light and heat are helpful here.

(34) *GA* III.11, 762a19-22, my translation. The last few words are of course an unattributed reference to one of Thales' reported opinions, directly ascribed to Thales at *de Anima* I.5, 411a7. For a good general discussion see James Lennox, "Teleology, Chance, and Aristotle's Theory of Spontaneous Generation," *Journal of the History of Philosophy* XX (1982) 219-238.

(35) *De Anima* I.5, 411a7ff.

enclosed in a frothy bubble, and the "heat of the warm season in the environment" (762b14) which "combines by concoction out of sea-water or earth."³⁶ But however the passage is interpreted, Aristotle has taken a direction that gives him an explanation of the generation of sea animals at the cost of part of his hylomorphism; one may say that he gains in cosmic integration what he loses in animal integrity.

Returning to the passage in II.3, we note in addition that the *pneuma* differs in value (τιμωότητι) in respect to the particular psychic heat which may be present in it. Here the differences between various lots of vital heat are explicitly qualitative rather than quantitative; we do not have to claim that the human semen is actually *hotter* than any other semen, only that its heat is qualitatively better. Reading a passage like this with a modern scientific agenda, we are left with an uneasy feeling, because we cannot envisage how one could go about verifying the hypothesis empirically. Still, we do get an impression of the sort of relationship which might exist between the various sorts of "heat" in the universe; firey heat, and aitherial heat might be so different qualitatively, in Aristotle's mind, that they don't fit on the same scale, and are thus analogous rather than continuous. At the same time, we might want to think that the "lower" kinds of heat are ultimately *derived* from the "higher."

Aristotle's denial of the thesis that the heat in the *pneuma* is derived from fire (i.e., his denial that a higher form of heat might be derived from a lower) may be part of a larger project of refuting the theory of the primacy of fire in the cosmos and in life. The name of Anaxagoras is often associated with the theory that the celestial bodies are fire, in the "cosmic" books;³⁷ Democritus is credited with identifying the soul as fire in the *de Anima*.³⁸ But Aristotle is more consistently opposed to the thesis that the stars are fire than he is to the thesis that vital heat is a form of fire. In *PA* II.2, when he provides what looks meant to be a thorough analysis of the various senses of the word "hot," he does not at all distinguish between vital heat and the heat of fire. In fact, he seems to assert that the process of digestion is an instance of combustion (ἐμπειπυρεῖσθαι, 649a27). Later in the book, at *PA* II.7, Aristotle again makes a much less rigid distinction between psychic heat

and fire than that made in *GA*, for example. Dealing with the function of the brain, he notes that:

Some writers assert that the soul of an animal is fire or some such power. This, however, is but a crude assertion; and it would perhaps be better to say that the soul is incorporate in some such body.

Noting the pervasive importance of heart for the functioning of the animal constitution, Aristotle goes on:

To say then that the soul is fire is much the same thing as to confound the auger or the saw with the carpenter or his craft.³⁹

Although Aristotle does not here argue that the "body" of the soul is *not* fire, he is seriously at pains to argue that the soul itself is not identical with fire. And he does not assert that fire is the body of the soul, only that "perhaps it is better to say that the soul subsists in τοιούτω τινὶ σώματι."

In *Juv.* and *Resp.*, Aristotle makes a clearer distinction, talking for example at *Juv.* 4, 469b8ff, about "some natural connate heat" which distinguishes between life and death; the heart is the hearth for this connate heat, and nutrition and the air may maintain the "natural heat" (6, 470a23). *Resp.* 8 tells essentially the same story; in fact respiration is taken to be primarily a *cooling* mechanism, and the ἐμφυτον πνεῦμα is the analogous cooling mechanism in non-breathing animals (9, 475a9).

Of course the distinction between the heat of fire and vital heat may be related directly to Aristotle's general theory that various lots of heat differ *qualitatively*, in terms of their *value*, quite as much or even more than *quantitatively*, in any measurable way. Aristotle doubtless thinks of the heat of fire as "low-quality" heat, which is why it cannot generate anything living. The heat of the sun and of the other celestial spheres is, obviously, very high quality heat, and consequently does generate, either by itself (so-called "spontaneous" generation), or in concert with the parents ("man and the sun generate the offspring").⁴⁰

Returning to the question of "mind": Aristotle has some rather obscure notions of relationships between *pneuma*, *aither*, heat, and light, on the one hand, and mind on the other. To be sure, νοῦς θύραθεν and νοῦς χωριστός, but the theory that mind is absolutely immaterial is a little crinkly around the edges. *Pneuma*, in the *GA* and *MA* at least, has the

(36) Allan Gotthelf suggested at the conference that the water-pneuma is enclosed, and the sun-heat makes the external envelope, according to II.1.11. That certainly is a possible interpretation of the passage, though I would want to suggest that the heat of the *pneuma* in sea-water must also be derived from the environment and the sun, since it is explicitly said that it is not derived from animals.

(37) *Cael* I.3, 270b24; II.3, 302b4; *Met* I.2, 339b22; II.9, 369b14 (in explaining lightning).

(38) *De An.* I.2, 404a1.

(39) *PA* II.7, 652b7-13, tr. Platt/Barnes, with "power" for δύναμις and "body" for σῶμα.

(40) *Metaphysics* A. 5, 1071a12: "The cause of man is the elements in man... and the external cause, whatever it is, e.g. the father, and besides these the sun and its oblique course, which are... moving causes." Cf. *GC* II.10 on the "oblique course" as moving cause. At *GA* I.16, 716a16, Aristotle remarks that the mythologists call the earth 'mother' and the sun and heavens 'father'.

function of carrying information from one location to another.⁴¹ We are tempted to relate this function of *pneuma* to the idea of *logos*, although that is not how Aristotle phrases it. Rather, *pneuma* and the psychic heat are said repeatedly to be an ἀρχή- of the animal, of generation, of movement. Peck makes the case that Aristotle's *pneuma* functions not only in generation and movement, but in perception as well, although this part of Aristotle's theory is far from worked out in any detail. If *pneuma* carries information within the body, for sensation and movement, it functions somewhat as we would say the nervous system functions. Indeed, once the nerves were discovered, they were believed (even by Galen) to be hollow tubes full of *pneuma*, so persuasive was the Aristotelian explanatory system. But if *pneuma* performs many of the functions of the nervous system, we would suppose that it must have a close relationship with mind.

And, as we noted above, man stands upright because he has more or better vital heat than other animals, and he needs to have that sort of vital heat because he is intelligent.

Finally, is there more than the surface significance in that famous passage, *de Anima* III.5, 430a14ff?

This sort of mind (passive) is such because it becomes all things, but the mind which is what is because it makes all things (active) is a sort of positive state (ἐξέως) like light; for in a way light too makes potential into actual colors.

Is the relationship between active thought and light more than metaphorical? I only want to call attention to the connection which Aristotle makes here; I do not have a developed interpretation.

3) BIOLOGICAL AND COSMIC PERIODS

We come now to a passage which is fundamental for understanding the relationship between *Metaphysics* Λ and the *Generation of Animals*, the passage at the end of *GA* IV. Aristotle is explaining why the period of gestation varies in different animals as it does. He starts by saying that the period of gestation bears some relation to the length of life, and then corrects himself and says that the larger the animal, the longer its gestation period is likely to be. But that (reasonable enough) explanation does not satisfy him; he goes on to find cosmic significance in the periodicity of the generation of animals.

We find, as we might expect, that in all animals the time of gestation and development and length of life aim naturally at being measured periods. By a period I mean, e.g., a day and night, a month, a year, and

(41) Cf. *GA* IV.3, 767b21; *MA* 10, 703a5ff.

the times measured by these, and also the periods of the moon... The moon is a first principle because of its connexion with the sun and its participation in its light, being as it were a second smaller sun, and therefore she contributes to all generation and development. For heat and cold varying within certain limits make things to come into being and after this to perish, and it is the motions of the sun and moon that fix the limit both of the beginning and of the end of these processes. Just as we see the sea and whatever is fluid* settling and changing according to the movement or rest of the winds (πνεύματα), and the air and winds again according to the course of the sun and moon, so also the things which grow out of these or are in these must follow suit. For it is reasonable that the periods of the less important should follow those of the more important. As for the revolutions of the sun and moon, they may perhaps depend on other principles.

It is the aim, then of nature to count the coming into being and the end of animals by the numbers of these higher periods, but nature does not bring this to pass accurately because matter cannot be easily brought under rule and because there are many principles which hinder generation and decay from being according to nature, and often cause things to fall out contrary to nature.⁴²

The first thing we should notice in this passage is that the *direct* cause of *genesis* and destruction of animals and other living things is "heat and cold varying within certain limits (μέχρι συμμετρίας)" (777b28). In other words, the claim is made that the orbiting sun and moon measure the life-span of entities by altering the "heat". By now we know enough about Aristotle's theory of "heat" that we should not too quickly say that the sun and moon simply change the "temperature", in our sense of the word. The issue is one of *celestial* heat, which is the highest quality of heat available in the universe. Of course we would agree that the influence of the sun upon environmental temperature-day and night, summer and winter, is obvious. As Aristotle makes clear in the *Generation and Corruption* and elsewhere, it is the "oblique cycle" which actually brings about the major differences; i.e., it is the fact that the sun is more toward the north in the summer, and toward the south in the winter, that makes the seasons. But he is talking about the *quality* of the environmental heat as much as its *quantity* or *degree*.

Aristotle appears to argue, without the sort of evidence we would expect, that the moon too has an influence on environmental heat. On the one hand, he has some empirical observations which indicate that

(42) *GA* IV.10, 777b16-778a9, tr. Platt/Barnes. At* I follow Peck's translation, which is more literal and more informative. Compare *GC* II.10, 336b10ff.

The times, i.e. the lives, of the several kinds of things have a number by which they are distinguished; for there is an order for all things, and every time (i.e. every life) is measured by a period. Not all of them, however, are measured by the same period. Not all of them, however, are measured by the same period, but some by a smaller and others by a greater one; for to some of them the period which is their measure is a year, while to some it is longer and to others shorter.

there are life cycles which follow the cycles of the moon: the clearest example is probably that of the sea-urchins, whose ὄβον (which Aristotle takes to be not an egg but fat) is largest at the full moon, "not because the animal eats more then, but because the nights are milder due to the light of the moon". Sea urchins also do better in summer, because of the warmth.⁴³ He knows that the woman's menstrual cycle tends to be the same length as the lunar cycle; he imagines that most women tend to be synchronized with the cycle,⁴⁴ because they should be synchronized with the supposedly warmer and colder parts of the month, according to the full and new moon.

Because Aristotle does not know about the gravitational pull of the moon, he does not have an adequate explanation of the moon's influence on bodies of water. He thinks that the changes of the moon bring about changes in the winds through heat and cooling, and the winds in turn bring about motions of liquids. Actually, I wonder whether Aristotle is not including both senses of the word *pneuma* in this passage. It does seem to me *possible* to read the passage that way. Wouldn't the heating and cooling of the environment have an influence on the "rest and movement" of *all pneumata*, whether winds, breaths, or connate air?⁴⁵

"It is reasonable that the periods of the lower follow the periods of the higher (κατὰ λόγον γὰρ ἀκολουθεῖν καὶ τὰς τῶν ἀκυροτέρων περιόδους ταῖς τῶν κυριοτέρων)." As *Metaphysics* Λ says, "All things are ordered together... and the world is not such that one thing has nothing to do with another, but they are connected." If the universe is organized according to a scale of value, so that some entities are τιμώτερα or κυριώτερα than others, then the lower should be expected to follow the leadership of the higher.

The principle thus enunciated is, in a way, a justification of the anthropocentric or anthropomorphic explanations with which the biological books are replete: it is absolutely to be expected that the lower animals be, in a way, more or less defective representations of the best

(43) *PA* IV.5, 680a31-34.

(44) *HA* VII.2, 582b1 (without modifiers); *GA* II.4, 738a20: "the period tends to return during the waning of the moon. This we should expect, for the bodies of animals are colder when the environment happens to become so, and the time of change from one month to another is cold because of the absence of the moon." At *GA* IV.2, 767a1, he adds that "as the sun makes winter and summer in the year as a whole, so does the moon in the month." In an earlier publication I speculated that Aristotle may have made a hasty generalization about the time of month at which women menstruate, on the basis of too little information. I now think that the generalization was pre-determined by the theory into which the observation was to be fitted.

(45) Earthquakes sometimes coincide with an eclipse of the moon because the wind (*pneuma*) turns off into the earth: *Meteorology* II.8, 367b20ff; cf. *Problems* XXVI.18, 942a22.

terrestrial creature, man. We should similarly expect that man is but a defective representation of the entities which are above. We can of course trace the analogy back to Heraclitus,⁴⁶ and we recall the trenchant criticism which Plato's Stranger makes of anthropocentric classifications, at *Statesman* 263d (the rational cranes might "invest themselves with a unique and proper dignity and classify the race of cranes as being distinct from all other creatures"). Probably Plato and Aristotle agree in not really having an *ultimately* anthropocentric mode of explanation, but rather taking as source and model of all understanding of the myriad creatures the structure of the universe as a whole.

If there really are "epistemological breaks" in the history of thought, we should certainly like to locate one of them in the vicinity of this passage. We generally do not have much difficulty with Aristotle's theory of the four causes so long as we talk about bronze statues, the human hand, or the elephant's nose, but as we read these passages from *Metaphysics* Λ, the *de Caelo*, and *GA* IV, we are struck by the strangeness of the application of the four causes to the universe as a whole.

In the first place, we do not know what to do with the claim that "all things are ordered together to one end." *Local* final causes can be understood according to biological functionalism; *universal* final causes are more puzzling, particularly when they are Aristotelian final causes. Our religious teachers, and Plato too, claim that the universe as a whole is an aesthetic object for God.⁴⁷ But Aristotle's God appears not to have the world as an object for thought, let alone as an object for aesthetic appreciation. How does an *army* contain the good? Yes, as the excellence of the general and of the organization which depends (partly) on the excellence of the general, but that's an inadequate answer. The goodness of an army belongs to its functional capacity as a fighting force; its excellence is judged by something outside itself, by the environment within which it functions. And the universe has nothing but God outside itself, according to Aristotle, and no environment by which it is judged.

Internally, the teleological order is just as puzzling to us. We can make sense of the notion that the various kinds of animals exist for the sake of the whole environment within which they function; even though most biological scientists will chide us for this way of thought, we can readily imagine that bees exist partially in order to pollinate flowers,

(46) Plato, *Hippias Major* 289b, apparently citing Heraclitus (DK B83), "The wisest of men appears to be but an ape in comparison with a god..." Cf. DK B79.

(47) *Genesis* 1.31: "And God saw everything that had made, and behold, it was very good." *Timaeus* 30d: "For the deity, intending to make this world like the fairest and most perfect to intelligible beings, framed one visible animal comprehending within itself all other animals of a kindred nature".

that scavengers exist partially in order to rid the environment of carrion. But what sense can be made of the idea that the entire terrestrial ecosystem exists for the sake of the lunar sphere, that everything within the lunar orbit exists for the sake of the solar sphere, that the solar system exists for the sake of the sphere of the fixed stars?

And I remind you that the *material* cause of the visible entities varies qualitatively as one proceeds from the center of the earth to the outer limits of the universe. That qualitative variation is most readily evidenced by the increasing regularity of the motion of entities as one proceeds outward, the increasing unity of the originating cause, the decreasing variability which might be introduced by the imperfections of the lower forms of matter (remembering especially *GA* IV.10).

The "epistemological break" may be a rather large one, something rather like a chasm in fact. We moderns expect that the *matter* of the universe is fundamentally identical; the current story is that it all reduces to the same few basic quarks. And we suppose that the physical laws governing the construction and motion of material things are also universally uniform. Aristotle does not talk of universal laws of nature, nor does he think the matter uniform. Although both we and Aristotle suppose the physical universe to be one and unified, for us that unification depends upon the laws governing the behavior of the ultimate matter (in that, we follow Democritus far more closely than Aristotle); Aristotle supposes the unification of the universe to be essentially formal and final.

In order to make his formal and final unity work, Aristotle needs to have *some* permeation of qualitatively superior matter into the sublunar world; thus the *pneuma* and the vital heat in the *pneuma* which makes possible the functions of life are said to be related, in some rather obscure way, to the celestial *aither*. To the modern mind, understanding the presence of *pneuma* in the terrestrial environment as a penetration of the celestial and the divine into the sublunar realm looks like a touch of mysticism, which is to say it is mysterious to us.

A Brief Comment On MA and Met. A.

The *de Motu Animalium* is a short treatise both very informative about many points in Aristotle's theory of animal local movement and terribly puzzling in the analogy drawn between the movement of animals and the movement of the heavens.⁴⁸ Putting aside the many

(48) Martha Nussbaum writes (*MA* p. 135): "We imagined that we knew what Aristotle was up to, and that his preoccupations were ours. And now the meticulous analyst is found constructing a picture of the heavenly bodies on the basis not of careful observation and measurement, but of popular superstition." She goes on to describe Aristotle as appearing here to be the "religious man" who fights for the right of supernatural to remain unexplained, of the marvelous to remain unchallenged by

problematic details, let us look briefly at the heart of the matter, at 6, 700b30:

It is clear that the eternally moved by the eternal mover, and the individual animal, move in the same way in one respect, but in another respect differently, in that the former move eternally, but the movement of animals has a limit.

Aristotle goes on to say that the eternal mover is eternally valuable, and implies that is why things which are moved directly by it move continuously, without stopping; animals, on the other hand, move in virtue of *orexis*, which is in a sense a moved mover, and has a limit. Animal movement (chapter 7) may be analyzed in terms of practical syllogisms, and those syllogisms (and the situations they represent) have "limits", namely the specific goals which are achievable by action.

Thus Aristotle says that the *most significant* difference between celestial and animal movement is in terms of the *final* cause of their movement: the celestial bodies move directly for the sake of the absolutely best, animals move for the sake of the relatively good. The theory may well be elucidated by quoting the continuation of a passage from *Metaphysics* A cited at the beginning:

It is as in a house, where the freemen are least at liberty to act randomly, but all things or most things are already ordained for them, while the slaves and beasts do little for the common good, and for the most part act randomly; for this is the sort of principle which constitutes the nature of each.⁴⁹

Aristotle tell us that free persons do not act randomly, because they are determined by their goals, not just their personal goals, both those of the entire community; slaves have only a limited understanding of what ought to be done, and consequently are relatively little determined by their concept of the good.

The passage may well be put in conjunction with this one from the *MA*:

The animal must be understood as constructed like a well-governed city, for once order is established in the city, there is no need for a separate monarch which has to preside over each activity; each individual does his own ordered task, and one activity follows another through custom. In animals this happens by nature...⁵⁰

reason." I differ with Nussbaum on two points here: a) we have no reason to expect Aristotle ever to measure anything (he never or almost never even suggests measuring something); b) Aristotle's picture of the heavens is not really based on popular religion (even less superstition), despite his claim to have derived it thus. Aristotle is more nearly engaged in the *establishment* of a religious dogma than in the retailing of an existing faith.

(49) *Met. A.* 10, 1075a19. G. E. R. Lloyd pointed out in the conference that the Ross/Barnes translation misleadingly says that "the freemen are least at liberty to act as they will" and that "the slaves... for the most part live at random" when the operative phrase in both places is $\delta\tau\epsilon\tau\rho\chi\epsilon\nu$.

(50) *MA* 10, 703a29-34, my translation.

The macro-level of the cosmic army or household of *Metaphysics A* is at least partly reflected on the micro-level in the animal as city, for we can ask the same question asked in the *Metaphysics*: how is the good contained in the *animal*, as the goodness of its leader or the arrangement of its parts? Probably in both ways... for the soul is that for the sake of which all the parts of the animal function, and the excellence of the soul is reflected in the excellent functioning of the parts, "once order has been established".

Last Word.

Are we in a position to understand Aristotle's cosmic teleology, or not? Our religious tradition tells us that the world is good because God made it that way; cosmic teleology exists in our religious, if not our scientific, imagination through the notion of *design* transferred from the human realm to the cosmos. But Aristotle's universe is eternal, not created, and therefore not designed. Nor is it good simply because it is beautiful, although it is beautiful. The answer, such as it is, is to be found at the beginning of Book II of the *Generation of Animals*:

Now some existing things are eternal and divine whilst others admit of both existence and non-existence. But that which is noble and divine is always, in virtue of its own nature, the cause of the better in such things as admit of being better or worse, and what is not eternal does admit of existence and non-existence, and can partake in the better and worse. And soul is better than body, and the living, having soul, is thereby better than the lifeless which has none, and being is better than not being, living than not living.⁵¹

Being is better than not-being. There, in a word, is the heart of Aristotle's teleology. The universe is as it is because it thus maximizes existence, soul, and mind. This is a faith, if you like a religious faith, but it is not simply an acceptance of popular superstition or an unquestioned assimilation of the religious tradition. It is the cornerstone of the possibility of thinking about the world in an Aristotelian way. Is it a way of thought which is available to us today, or have we become separated from that way of thought by an unbridgeable epistemological chasm? Do we want to say that we are no longer sure whether existence or non-existence is better? Or if we do accept the premise that existence is better than non-existence, must we also be committed to a picture of the universe as thoughtfully going around in perfect circles forever?

I'd like to say that we are not separated from the premise that existence is better than non-existence, and that we need not be committed to a closed universe to accept that premise; in a way, our universe is all the more excellent than Aristotle's for being more vast and no less regular. But that is quite another story altogether.

(51) *GA* II.1, 731b24-30, Platt/Barnes.

HOMÉOMÈRES ET ANHOMÉOMÈRES EN THÉORIE BIOLOGIQUE D'ARISTOTE À AUJOURD'HUI

RENÉ THOM

S'il est une partie de l'œuvre d'Aristote qui, actuellement, semble irrémédiablement périmée, c'est bien sa théorie de l'organisation biologique; elle repose — on le sait — sur le couple des notions : homéomère-anhoméomère. Une telle distinction, fondée sur l'examen phénoménologique des organes mis en évidence par dissection — sans autre moyen que l'examen visuel — pourra sembler, à nous modernes, tout à fait rudimentaire. Pourvus du microscope, nous savons depuis plus d'un siècle que l'être vivant se décompose en cellules, chaque cellule constituant en quelque sorte l'unité indivisible, l'atome du vivant. Mais il n'est pas sûr que cette connaissance frappe d'invalidité toute tentative d'expliquer théoriquement — de *formaliser* — la structure *visible* de l'organisme pluricellulaire. Nous pensons au contraire que les structures grossières mises en évidence par l'examen visuel constituent un "niveau hiérarchique d'organisation" — notion obscure qu'il nous faut certes élucider —; on montrera qu'un tel niveau est pourvu d'une certaine autonomie — laquelle permet une *description intelligible* indépendante des structures fines cellulaires ou subcellulaires. Cette tâche s'inscrit dans le droit fil des considérations du *De Partibus Animalium* (noté P.A.) et du *De Generatione Animalium* (noté G.A.), elles-mêmes issues des considérations plus générales de la Physique (Φ) et de la Métaphysique (Met.).

I. Les Homéomères. Hypothèse sur l'origine.

La définition et les propriétés générales des homéomères et anhoméomères sont données au livre II de P.A., après le livre I qui, lui,

est consacré à une critique méthodologique de la dichotomie platonicienne. Apparemment, aucun lien évident ne relie le contenu des deux livres. Nous allons ici proposer une certaine reconstruction de ce « chaînon manquant »¹. Pour cela il nous faut revenir à la découverte par Aristote du substrat matériel. Selon la thèse défendue par D.W. Graham dans son livre « Aristotle's two systems »², l'auteur des Catégories serait initialement parti de la conception d'un « atomisme substantialiste » (celle de l'Organon), où deux prédications : X est A, X est B sont contradictoires si A et B sont deux qualités contraires d'un même genre, X étant une entité (première). Pour rendre compte du devenir et du mouvement (et réfuter Parménide), Aristote aurait alors introduit le substrat (ὑποκείμενον) — à savoir la matière —, qui seul permet la consécution temporelle de deux prédications d'une substance (ousia). Je proposerai ici qu'une autre motivation — plus immédiate — a pu jouer dans l'invention du substrat. Aristote était trop conscient des faits de langage pour ne pas s'apercevoir qu'une assertion telle que

(NB) Ce chat est noir et blanc

est parfaitement acceptable d'un point de vue sémantique (et linguistique) et cependant dans un univers d'atomisme substantialiste, une telle phrase serait intrinsèquement contradictoire (comme elle le serait en logique Booléenne moderne — un fait dont nos théoriciens des Mathématiques Modernes n'ont pris conscience que bien tardivement)³. C'est dire que le rôle du substrat est non seulement de permettre le changement, le devenir, mais aussi la *coexistence simultanée* dans une

(1) Il n'entre pas dans mon propos ici de discuter le lien relatif (ou l'absence de lien) entre le livre I de P.A. et les livres II-IV qui suivent. On sait les controverses entre érudits auxquelles ce problème a donné lieu. Le livre I fut-il un traité méthodologique autonome rattaché ultérieurement aux anciens livres? Leur est-il antérieur ou postérieur? S'il m'était permis d'exprimer ici l'opinion d'un incompetent, je dirais qu'à beaucoup d'égards, l'introduction des homéomères et anhoméomères en Biologie apparaît comme une tentative de sauver la méthode diairétique des difficultés qui dans le domaine de ces êtres concrets que sont les organismes animaux, ruinent l'efficacité de la belle méthode logique de l'Organon. Par la vision générale du rôle de la nature, de la matière, de la forme et des causes finales, le livre I de P.A. me semble très proche des livres II et III de la Physique; ceci conforterait l'impression générale d'un intérêt relativement précoce d'Aristote pour la Biologie — sans doute non antérieur aux grands traités philosophiques de la Physique et de la Métaphysique, mais de fort peu postérieur. (Voir les observations de P. Pellegrin sur la théorie opposée de d'Arcy Thompson, note de bas de page 51 de CAA).

(2) Ici encore, mon incompetence ne me permet pas de juger de la validité de la thèse de D.W. Graham. On peut croire à une évolution « à la Wittgenstein » (si l'on permet cette comparaison sans doute fort inadéquate). Parti d'un logicisme rigoureux, préoccupé d'abord de combattre les Sophistes, le Stagirite aura mûri en un philosophe de la nature, dont le but essentiel était de conférer au monde sensible l'intelligibilité.

(3) Voir à ce sujet mon article : « Les Mathématiques Modernes, une erreur pédagogique et philosophique? » in « L'Âge de la Science », juillet-sept. 1970, vol. III, Dunod ed., Paris, particulièrement l'Appendice p. 235-42.

entité de « parties » ayant des qualités différentes, voire contraires. Ainsi le pelage du chat, sujet de la phrase N.B., se divisera en une partie blanche, et une partie noire. La notion d'homéomère permet ainsi de recouvrer un certain atomisme substantialiste dans le cas d'une entité qualitativement composite⁴. Ici, bien entendu, on pourra m'objecter qu'entre en jeu le caractère étendu, spatial, du substrat, et qu'Aristote a refusé avec l'obstination la plus complète, toute considération de l'espace, pour lequel il n'a aucun mot. (On pourrait penser que ὅλη τοπική représente l'étendue, mais il s'agit d'un hapax dans le corpus). Ce serait oublier que pour lui la plupart des substrats (sinon tous) sont des continus⁵. On voit donc que si (B) est le corps d'un animal, en associant à chaque point x de B la totalité des « qualités » susceptibles d'être prédiquées d'un voisinage de x dans B, on définit une partition de (B) en classes d'équivalence; une telle classe d'équivalence constituera un « homéomère ». Les exemples donnés par Aristote d'homéomères (le sang, la chair, la moelle des os, etc.) sont des « volumes » de l'espace (des étendues tri-dimensionnelles); deux tels homéomères contigus sont séparés par une « cloison » qui est une surface S. On peut alors définir pour (S) une partition en homéomères de la même manière, en exigeant que les voisinages de 2 points de S aient des voisinages dans B qualitativement « homéomorphes »... et ainsi de suite : (S) aura pour bord des courbes qui sont des homéomères de dimension 1, lesquels auront pour bords des points (dimension zéro). Ainsi cette notion d'homéomères conduit à munir le volume (B) d'une partition en « variétés connexes » X_i (les strates) qui sont des homéomères de dimension 3, 2, 1, 0. On retrouve ainsi l'objet connu en mathématique sous l'appellation d'ensemble stratifié. Un polyèdre est un ensemble stratifié : par exemple le cube classique, I^3 , se décompose en :

1 strate de dimension 3 : l'intérieur

6 strates de dimension 2 : les faces

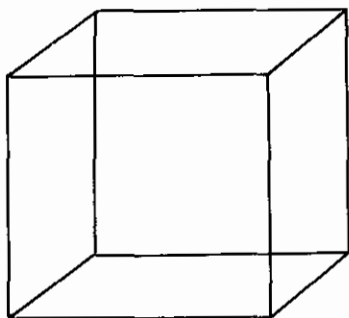
12 strates de dimension 1 : les arêtes

8 strates de dimension 0 : les sommets

(observer que $8 + 6 - (12 + 1) = 1$, relation d'Euler).

(4) V. Cherniss (Aristotle's criticism of Plato and the Academy, p. 175, note de bas de page) a invoqué le passage 329d du Protagoras comme source possible de la notion d'homéomère. Il est curieux de constater que dans la suite du dialogue de Platon, Socrate confond Protagoras à l'aide d'arguments sophistiques jouant sur la notion de « parties » d'une entité, laquelle conduit à des apories dans le cadre de l'atomisme logique. D'où la question : Quel fut le statut du « substrat » dans l'Académie?

(5) Rappelons que pour Aristote le continu (συνεχές) est le « substrat intrinsèque » (ὑποκείμενον καθ' αὐτό) de l'infini (ἄπειρον) Φ III 208a. Or l'ἄπειρον est fréquemment (sinon toujours) identifié à la matière (ὕλη). Cf. la citation Φ III, 207a35.



Pour un ensemble stratifié usuel de la Mathématique (par ex. un ensemble défini par des équations analytiques $f_i(x_j) = 0$), il y a toujours une stratification telle que les strates aient des plus tangents qui sur leur bord se recollent continuellement⁶. Il y a des modèles polyédraux de la stratification en tout point d'un tel ensemble; une strate ne peut se ramifier indéfiniment quand elle se rapproche de son bord.

La notion d'homéomère soulève d'assez grosses difficultés conceptuelles pour qui n'a pas la « culture » que donne l'étude topologique des espaces définis en Géométrie Algébrique ou Analytique. Au sens strict, un homéomère définit — lorsqu'il s'agit d'un homéomère de dimension trois (un « volume »), une nature qualitative locale de la matière sensible — pour la science moderne : un état physico-chimique local. Ainsi pour Aristote, un élément tel que l'eau, une substance minérale telle que le cuivre, l'argent, un milieu organique « homogène » tel que le sang, la moëlle, l'intérieur de l'os, la « chair », sont des homéomères. Ainsi défini par une qualité phénoménale locale, l'homéomère n'a pas de forme propre. Mais il a cependant une « quiddité », un « logos », qu'Aristote associe à ses capacités d'interaction lorsqu'il est mélangé avec d'autres homéomères. (Mais ce « logos », dit-il, est difficile à définir : οἱ λόγοι αὐτῶν οὐκ ἀκριβεῖς : *Météorologiques* IV 12, 390a14-20). Le mot homéomère s'emploie aussi à propos de toute composante connexe d'un tel milieu — toute *strate* en terminologie mathématique. Laissons ici de côté les

(6) La notion d'espace stratifié est apparue en mathématique vers les années 1965-70 par suite de la nécessité de décrire la structure interne d'un ensemble analytique, i.e. un ensemble E défini (localement) par un système d'équations analytiques $f_i(x_i) = 0$. Quant à la relation d'équivalence phénoménologique locale de deux points, elle est à l'origine du formalisme de la « théorie des catastrophes ». Voir à ce sujet « Stabilité Structurale et Morphogenèse », notion de point régulier et de point catastrophique [SSM, p. 40]. Les ensembles stratifiés sont caractérisés techniquement par des propriétés de régularité locale de leurs plans tangents (Propriétés a, b de Whitney). Pour leur définition, voir le livre récent « Stratified Morse Theory », par M. Goresky, R. Mc Pherson, Springer Verlag, 1988.

strates de dimension < 2 . Une strate de dimension deux est une surface qui sépare deux milieux homéomères qualitativement distincts; ainsi les surfaces telles que les membranes pulmonaire ou intestinale sont des homéomères de dimension 2 (transversalement, ce sont des anhoméomères puisqu'elles séparent deux milieux différents). Une strate peut avoir une topologie intrinsèque qui lui donne une *forme* globale (non euclidienne). Ainsi Aristote a remarqué qu'une veine est topologiquement un cylindre $S^1 \times I$ (avec les notations bourbakistes : S^1 = cercle, I = segment, $\times$ = produit d'espaces); lorsqu'elle est fendue longitudinalement, elle donne naissance à des fragments, homéomorphes au carré $I \times I$, qui ne sont pas de même forme que la veine cylindrique initiale (P.A. II 647a19).

Signalons encore une autre difficulté : Une strate, avons-nous dit, ne peut se ramifier indéfiniment quand elle se rapproche de son bord. C'est cependant, apparemment, le cas pour certaines structures biologiques : ainsi l'homéomère sang a pour bord le tissu vasculaire, qui constitue la paroi des veines et des artères. Or veines et artères se ramifient en des conduits de plus en plus petits, jusqu'à former des capillaires invisibles à l'œil nu. Ici encore Aristote a eu conscience de cette difficulté : il compare le système vasculaire aux rigoles d'irrigation d'un jardin (P.A. III, 668a10-13); et il n'hésite pas à dire que le sang n'est pas une « partie » de l'organisme animal proprement dite : τὸ αἷμα : οὐδεν γὰρ τῶν ζώων μέρος (P.A. 656b21) : En effet le sang est pratiquement présent (partout dense, diraient les mathématiciens) dans tout l'organisme, sauf dans quelques excroissances périphériques comme poils, dents et ongles. Ce n'est que tout récemment que l'attention des scientifiques a été attirée sur ce type de formes ramifiantes, baptisées « fractales » par B. Mandelbrot. (Voir B. Mandelbrot 1977).

II. Genos et Eidos.

La notion d'homéomère soulève une autre difficulté — plus essentielle peut-être —. En effet, l'équivalence phénoménologique locale ne peut être définie que si on sait décider si deux voisinages U_x , U_y de deux points x , y de l'organisme ont ou non même apparence qualitative. Or ici nous rencontrons une notion fondamentale de l'aristotélisme, à savoir, le couple genos-eidos, traduit canoniquement en Genre-espèce. Deux qualités (a), (b) (par ex. deux couleurs) sont dites appartenir au même genre, si on peut les déformer continuellement l'une dans l'autre (par expérience mentale). Le genre doit donc être vu comme une « ὅλη », un continuum qualitatif dans lequel les différences (διαφοραὶ) découpent des frontières qui séparent ce genre en εἶδη distinctes. On peut ainsi dans une métaphore dynamique voir le genre comme un fleuve se ramifiant dans un delta (chacune des branches de la ramification constitue un eidos). Il

est clair dès lors qu'on pourra définir deux modes d'équivalence selon la phénoménologie locale : en imposant aux deux points x, y d'avoir des voisinages rentrant qualitativement soit dans un *genre (sensible) commun*, soit dans une *espèce commune*, la première relation étant moins fine que la seconde. On posera en principe qu'un $\Gamma\acute{\epsilon}\nu\omicron\varsigma$ n'est autre qu'une classe d'équivalence définie par l'*isologie* (donc l'homéomorphie) des stratifications (γ) (γ') définies sur la boule (B^3) par l'équivalence phénoménale locale selon le « genre ». Si on adopte l'équivalence locale du point de vue plus fin de l'équivalence des « eïdè », alors on définira une « espèce » ($\epsilon\acute{\iota}\delta\omicron\varsigma$). De manière plus précise : deux organismes (O_1) (O_2) sont dits de même Genos g , s'il existe un homéomorphisme $H : (\mathbb{R}^3, O_1) \rightarrow (\mathbb{R}^3, O_2)$ telle que l'image par H d'un homéomère $(h_1) \subset O_1$ de genos Γ est un homéomère $h_2 = H(h_1)$ de même genos Γ' . Comme l'a bien vu D'Arcy Thompson, ce qu'Aristote appelle l'équivalence *par excès ou par défaut* est en fait l'équivalence topologique. L'auteur de « On Growth and Form », qui fut un traducteur de l'*Historia Animalium* (et un commentateur souvent original de ces textes) avait — sur ce point essentiel — compris Aristote beaucoup mieux que les commentateurs traditionnels. Il reconnaît avoir tiré d'Aristote l'idée de ses célèbres diagrammes d'équivalence entre espèces de poissons⁸. Appelons G l'ensemble des *gené* associés à un groupe biologiquement défini (soit « populairement », c'est-à-dire informellement comme le $\Gamma\acute{\epsilon}\nu\omicron\varsigma$ des poissons, soit une « espèce » (au sens moderne) définie par la stabilité de la reproduction (l'interfertilité) des individus de ce groupe); pour l'équivalence plus fine selon les eïdè (on admettra que ces eïdè ont une certaine stabilité héréditaire dans ce second cas). La classe d'équivalence sera dite également une *espèce* ($\epsilon\acute{\iota}\delta\omicron\varsigma$). Chaque espèce est dans un genre. On a donc une application canonique Ψ de l'ensemble (ϵ) des eïdè dans l'ensemble (G) des *gené*. Ainsi, par ce morphisme, $\Psi : (\epsilon) \rightarrow (G)$, chaque *genos* $g \in G$ se subdivise en un certain ensemble $\Psi^{-1}(g)$ d'eïdè dont les représentants ont une organisation identique (même « type topologique ») selon l'eïdos. Il suffit pour cela qu'au moins un *genre* Γ qualifiant un homéomère pris dans le représentant canonique du genre (g) admette une variation topologique (ou qualitative) dans sa subdivision en $\epsilon\acute{\iota}\delta\eta$. Bien entendu la

(7) L'homéomorphisme H peut ne pas s'étendre à des organes petits, fins et nombreux « Deux chats n'ont pas nécessairement le même nombre de poils » (Thom, SSM). On doit au naturaliste François Grandjean la distinction entre caractères *ortholaxiques* (liés à la structure et conservés par H), *pléholaxiques* (non conservés numériquement) et *cosmolaxiques* (non conservés numériquement, mais dont la plage d'occupation est globalement conservée en forme). Voir à ce sujet l'article de Yves Bouligand « Listes de priorité », in *Biologie Théorique*, Solignac, éd. Y. Bouligand, Éditions du CNRS 1989.

(8) Diagrammes de D'Arcy Thompson, in « On Growth and Form », Sir D'Arcy W. Thompson, Abridged edition, ed. J. T. Bonner, Cambridge Univ. Press, 1961, pp. 300-301, citation d'Aristote p. 273).

précision de cette définition n'est le plus souvent qu'illusoire, car la division d'un $\Gamma\acute{\epsilon}\nu\omicron\varsigma$ en $\epsilon\acute{\iota}\delta\eta$ n'est précise que très théoriquement (La formule [P.A. I, 643a24] : « Ἐστὶ δὲ διαφορά τὸ εἶδος ἐν τῇ ὅλῃ » procède plus du *wishful thinking* que de la réalité observable : pour les couleurs par ex. (P.A. I, 643a24), les bassins imprécis des adjectifs de couleurs dans l'espace $\mathbb{R}^{3+}$ des impressions de couleur empiètent les uns sur les autres : qui fixera la limite, sur le spectre, entre le pourpre et le violet ? Mais ces définitions, quoique d'application difficile, fournissent néanmoins une interprétation cohérente de l'emploi de $\Gamma\acute{\epsilon}\nu\omicron\varsigma$ et $\epsilon\acute{\iota}\delta\omicron\varsigma$ dans les traités biologiques d'Aristote. Faute d'avoir vu que ces termes sont liés à une classification *morphologique*, — les « Baupläne » des organismes — et que l'interfertilité n'y joue qu'un rôle inessentiel ou nul, on s'est accroché bien à tort à la notion d'espèce de la biologie moderne. Le contre-exemple évoqué par P. Pellegrin dans CAA* à propos du genre cartilage-os vient en fait à l'appui de la thèse : cartilage et os fusionnent « par symphyse » dans les organismes, car, au cours du développement, le cartilage devient souvent os. La distinction cartilage-os procède ainsi selon le *genos* ou l'eïdos suivant qu'on considère la différence comme réalisée en acte ou non.

Tout ce qui vient d'être dit de « $\Gamma\acute{\epsilon}\nu\omicron\varsigma$ » et « $\epsilon\acute{\iota}\delta\omicron\varsigma$ » n'est vrai, évidemment que si *aucune différence* (*diaphora*) *n'est nommément spécifiée*. Si les différences sont spécifiées, alors, bien entendu, *Genos* et *eïdè* sont de ce fait automatiquement spécifiées ; lorsque ces différences portent sur la physiologie (comme dans la distinction entre ovipares et vivipares, ou celle entre animaux terrestres, aquatiques ou aériens), alors les eïdè peuvent n'avoir rien à faire avec la définition d'équivalence morphologique donnée plus haut. En fait, il y a des relations entre les deux définitions (tout oiseau a des ailes), mais, là justement, entre en jeu toute la problématique des rapports entre structure et fonction. Nous y reviendrons.

L'idée de définir toute différence $\epsilon\acute{\iota}\nu\ \tau\acute{\omega}\ \lambda\acute{o}\gamma\omega$ discutée dans CAA, pp. 94-100, me semble appartenir à la mythologie d'atomisme substantialiste qui fut celle du premier Aristote. Très tôt Aristote s'est rendu compte que les genres étaient multidimensionnels et qu'on ne pouvait les engendrer par des couples de contraires qu'au prix de contorsions logiques dont les obscurités du livre I de la *Métaphysique* donnent une assez fidèle image. Mais comme Aristote n'a à sa disposition aucune représentation multidimensionnelle des genres, il en est réduit au seul moyen de description de lui connu : la jonction par liaison des contraires. Par ailleurs traiter d'accidentelles des différences perceptibles comme la couleur serait difficilement admissible de la part d'un

(*) Par le sigle CAA nous désignons l'ouvrage de P. Pellegrin : La classification des animaux chez Aristote, Les Belles Lettres, Paris, 1982.

biologiste. Sans doute l'ousia est-elle (Aristote le rappelle en P.A., 644a, 29) un « atome selon la forme » : τὸ τῷ εἶδει ἄτομον. Mais l'eidos est alors la « forme propre » de l'ousia, et non un universel général comme la couleur. Dire que : οὐ διαφορὰν ποιεῖ ἢ ὅλη (Met. I 1058b6) (la matière ne fait pas de différence), n'empêche que c'est la matière sensible qui *supporte* la différence et qui la manifeste. L'axiome précédent vaut (peut-être) de la mythique « materia prima », mais non de la « materia signata » qui est la seule accessible à l'investigation de l'observateur. Il est vrai que tout genre est divisé par des différences « spécifiques ». C'est ici qu'un modèle géométrique de la prédication peut être utile : Soit G un genre de qualités sensibles (la couleur, par exemple). Supposons que la matière du genre⁹ constitue un espace euclidien G (comme l'espace $\mathbb{R}^{3+}$ des impressions de couleur). Les différences (diaphorai) seront portées par un ensemble catastrophique (K) *fermé et canoniquement défini dans* (G). L'ensemble (K) va découper dans (G) des blocs distincts (ϵ_i) qui définiront les eidé du genre. L'état qualitatif d'une entité première X relativement au genre (G) (par exemple la couleur) est définie par une application *continue* $\sigma : |X| \rightarrow G$ ($|X|$ désigne le substrat de l'entité X) où $\sigma^{-1} : (\epsilon_i)$ sont les *homéomères* de X. C'est là ce qu'Aristote a voulu exprimer par la formule : « la matière n'opère aucune différence (dans le genre) », formule qu'on comparera à : « La différence est l'eidos dans la matière », P.A. I, 643a24.

Dans ce formalisme, l'ensemble K décrit le genre et sa décomposition en eidé; l'application σ décrit la qualification de la matière (du ressort de l'accident, selon l'Aristote de Met. J). Mais une moriologie (si elle existe) a précisément pour but de contrôler ces accidents et d'en donner raison.

III. Les Anhoméomères.

En dépit du « flou » inhérent à la définition d'une qualité, la notion d'homéomère est une notion conceptuellement précise; en ce sens, la partition (la « stratification ») d'un organisme en ses homéomères définit ce qu'en termes modernes on peut appeler son « organisation ». Il s'agit là d'une définition intrinsèque, morphologique, celle que décrivent les planches anatomiques. Mais les éléments de cette partition (les strates)

(9) L'emploi du terme « matière du genre » est considéré par certains commentateurs comme une pure métaphore. Mais comme le dit excellemment V. Cherniss : « If it is a metaphor, it is a metaphor of fundamental significance ». Dans la définition du Genos (Met Δ 28) comment concevoir l'expression τὸ πρῶτον κινῆσαν ὁμοειδέες, 1024b8, le « mouvant originel indifférencié », sinon comme la matière primitive qui va s'écouler à travers le crible des différences pour se fragmenter en blocs partiels (les eidé)? (aspect que la traduction de Tricot rend fort peu).

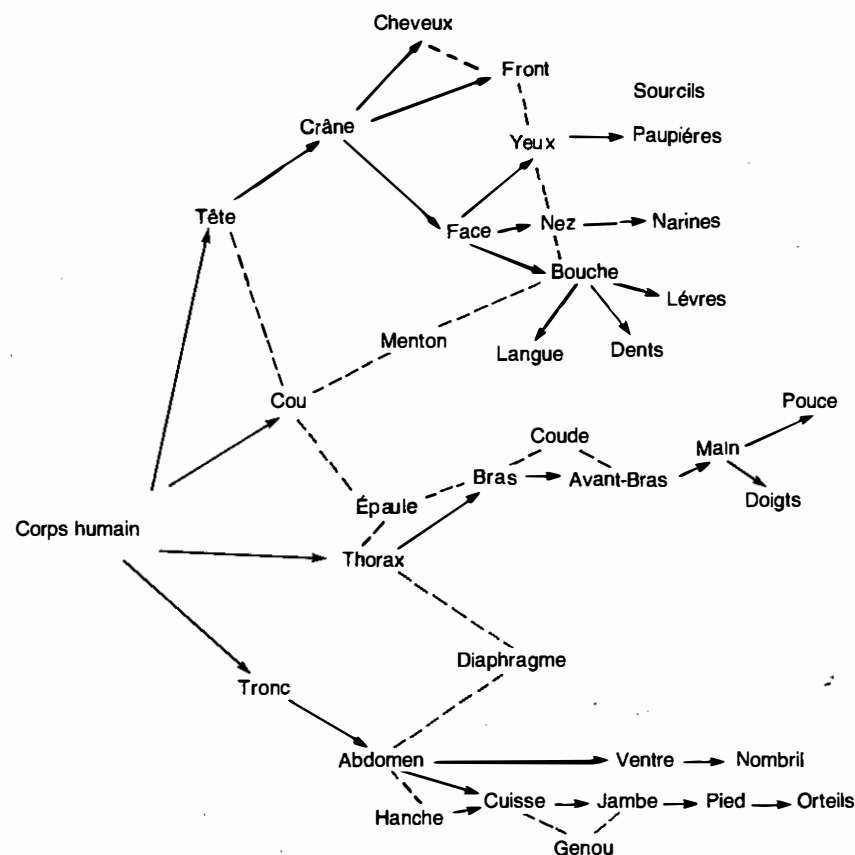


Fig. (C) Diagramme (M)

ne répondent que difficilement à la notion usuelle de « partie » d'un animal. Par exemple le « sang » existe pratiquement dans toutes les parties usuelles du corps humain (tête, bras, peau, etc.) souvent sous forme invisible; et les strates de dimension 2, 1, 0, ne portent en général aucun nom. C'est pour être en mesure de retrouver les parties au sens usuel — traditionnel — de l'organisme qu'Aristote a introduit le concept d'*anhoméomère*. Un anhoméomère est une réunion d'homéomères. Mais il n'est nullement précisé chez Aristote comment se définit l'*individualité* d'un anhoméomère, ni même s'il a des frontières morphologiquement définies. La seule indication un peu précise est que l'anhoméomère est le siège de travaux et d'activités (ἔργα καὶ πράξεις, P.A. II, 646b12), autrement dit, l'anhoméomère est en principe défini par une vocation fonctionnelle.

Si l'on considère les parties du corps humain, telles qu'elles sont définies dans le langage naturel, on observera d'abord qu'il y a une très grande « universalité » de langue à langue dans cette décomposition¹⁰. En sorte qu'on peut penser que cette partition est fondée sur des mécanismes psychiques profonds communs à toute l'humanité. (Très probablement les partitions analogues faites sur le corps des animaux procédant d'une projection anthropocentrique). On peut s'efforcer de décrire cette organisation par une structure ramifiante en arbre.

On constate d'emblée qu'il y a difficulté à présenter cette décomposition « naturelle » par un arbre constitué de ramifications dichotomiques successives. En effet, d'une part certaines structures sont visiblement transitionnelles comme le Cou entre Tête et Tronc, l'Épaule entre le Tronc et le Bras, la Hanche entre le Tronc et la Cuisse, le Menton entre le Cou et la Bouche... en sorte qu'on ne peut se contenter d'une structure en arbre. On a besoin à la fois d'une relation d'inclusion (X partie de Y) (notée $X \rightarrow Y$) et d'une relation de proximité (A contigu à B) notée $A \dots B$; la relation d'inclusion a très souvent une interprétation fonctionnelle (tel doigt fait partie de la main), alors que celle de contiguïté n'a souvent aucune fonction évidente. L'individualité de chaque anhoméomère est donc souvent difficile à définir; en effet, les « organes » au sens traditionnel du mot n'ont souvent pas de frontières morphologiquement évidentes. Si l'on considère par exemple un couple d'anhoméomères tel que Pouce $\rightarrow$ Main, on constate qu'il n'y a pas d'homéomère qui définisse la frontière entre le Pouce et la Paume de la Main. Au niveau du squelette, on peut certes trouver une telle frontière dans la surface d'articulation qui sépare la phalange du Pouce d'avec l'os contigu de la paume (le métacarpe). Mais cette « cloison » ne se prolonge ni dans la chair qui entoure les os, ni sur la peau, où elle n'est marquée que par une abrupte différence d'orientation (dans la zone interdigitale¹¹). Ceci montre qu'il n'y a pas coïncidence entre la description d'un organisme par homéomères et celle définie par ses anhoméomères. Un anhoméomère n'est pas nécessairement limité par des homéomères de la stratification du « Genos ».

On voit qu'ainsi la distinction homéomère-anhoméomère recoupe la définition moderne : Structure-Fonction. Les homéomères définissent la structure, les anhoméomères les fonctions. Comme le rapport entre

(10) Sur l'universalité des dénominations des parties du corps, voir Andersen, ES, 1978, Lexical Universals in Body parts terminology in Greenberg, ed. 1978, *Universals of human Language*, Stanford, tome 3, 335-86.

(11) On observera que ces zones digitales, issues de la palette palmée chez l'embryon proviennent par nécrose génétiquement programmée de ces secteurs interdigitaux. Évidemment la variabilité angulaire des directions des doigts nécessite cette destruction; les frontières de l'anhoméomère pouce contiennent une telle zone fonctionnellement variable — mais non différenciée en tant qu'homéomère.

structure et fonction est un problème crucial de la théorie biologique (ce fut le thème de la célèbre controverse académique de 1830 entre Cuvier et Geoffroy Saint Hilaire), on conçoit l'importance qu'il y a de préciser ce rapport. Pour cela nous évoquerons d'abord un cas pur.

Le cas pur. Il s'agit du cas où l'anhoméomère est composé d'un seul homéomère. Un tel anhoméomère ne peut être de dimension trois, c'est donc au plus une surface, cloison ou membrane entre deux homéomères distincts et contigus. C'est le cas de certains anhoméomères cités par Aristote : l'intestin, le poumon. Considérons ce dernier cas.

La vocation fonctionnelle du poumon s'exprime dans le cycle d'hystérésis aVAv issu de la catastrophe fronce (voir Thom [1986]).

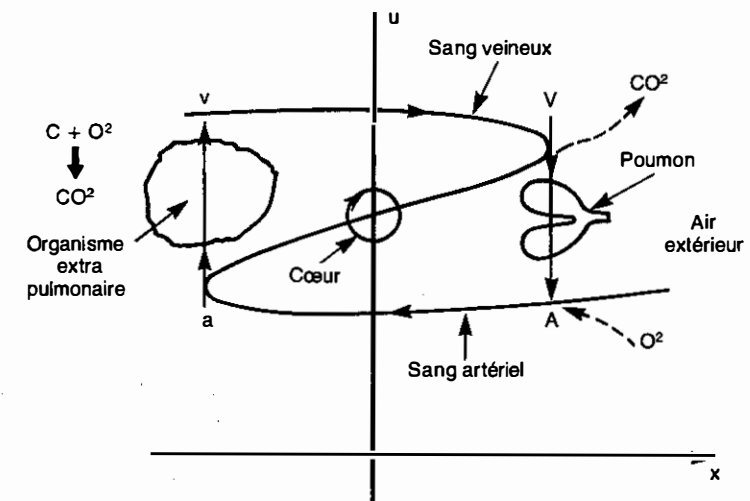


Diagramme (Δ)

VA poumon
av organisme extrapulmonaire
vV sang veineux
Aa sang artériel

en ce cas l'anhoméomère est une surface, où se font les transferts gazeux entre l'air et la sang.

Si l'on paraphrase la terminologie de P.A. II, 646a13, 646b20, on sera amené à dire que les homéomères vV et aA sont en puissance (car ils ont des pouvoirs (δυνάμεις) Ibid. 646b20) et ces pouvoirs se réalisent en acte sur les verticales av, AV... En projetant le cycle sur l'axe de la variable de contrôle X, les organes (Poumon, Chair) sont en acte par

rapport à ces homéomères mobiles que sont le sang veineux et le sang artériel. Dans un cas de ce genre, l'organe support de l'acte est «bord» de l'homéomère qui se dirige vers lui. Situation qu'on résumera par

l'axiome ABP : L'acte est *bord* de la puissance.

Dans un article à paraître (Thom 1988) j'ai étudié les connotations *géométriques* de l'opposition puissance-acte telles qu'elles apparaissent dans le corpus aristotélicien.

La règle ABP s'appuie sur quelques métaphores essentielles chez Aristote : la matière ($\alpha\lambda\eta$) s'identifie à l'indéfini ($\alpha\pi\epsilon\iota\rho\omicron\nu$); et la forme ($\epsilon\iota\delta\omicron\varsigma$) limite la matière comme la sphère bord limite le gaz contenu dans un récipient sphérique... Typique est la phrase (Φ , III, 207a35) : l'infini est enveloppé comme une matière interne, c'est la forme qui l'enveloppe : $\pi\epsilon\rho\acute{\iota}\epsilon\chi\epsilon\tau\alpha\iota\ \gamma\acute{\alpha\rho}\ \acute{\omicron}\varsigma\ \eta\ \alpha\lambda\eta\ \acute{\epsilon}\nu\tau\omicron\varsigma\ \kappa\alpha\iota\ \tau\omicron\ \alpha\pi\epsilon\iota\rho\omicron\nu,\ \pi\epsilon\rho\acute{\iota}\epsilon\chi\epsilon\iota\ \delta\epsilon\ \tau\omicron\ \epsilon\iota\delta\omicron\varsigma$.

La forme, c'est toujours l'enveloppe ($\pi\epsilon\rho\acute{\iota}\epsilon\chi\omicron\nu$), c'est aussi le $\pi\acute{\epsilon}\rho\alpha\varsigma\ \acute{\alpha}\kappa\acute{\iota}\nu\eta\tau\omicron\nu\ \pi\rho\acute{\omega}\tau\omicron\nu$ (Φ IV, 212a) (la première limite fixe de la théorie du lieu), l'enveloppe de la théorie des enveloppes : Le solide au contraire, rigide, a une forme identique à elle-même. C'est par essence le domaine du $\tau\acute{o}\ \tau\acute{\iota}\ \eta\nu\ \acute{\epsilon}\iota\nu\alpha\iota$, où la forme — permanente — s'identifie à son substrat : pas étonnant donc, si c'est aussi le domaine du Logos ! Le cas intermédiaire est celui du liquide (l'eau dans un tonneau) (Φ IV, 211b3) : là la forme de l'eau est délimitée d'une part par la forme du contenant (le tonneau) et d'autre part par la quantité du liquide contenu. Il y a donc ici une détermination *mixte* de la forme — la matière intervenant par sa quantité, sa «masse». Ce dernier type de rapport matière-forme semble fondamental dans certains mécanismes de l'Embryologie. (C'est celui décrit par la métaphore célèbre du *moule interne* de Buffon).

De manière générale l'opposition puissance-acte est affectée d'une essentielle ambiguïté. D'une part, on peut dire que du point de vue de l'évolution temporelle, la puissance engendre l'acte. Or, on sait (et les anciens le savaient) que le point par son mouvement engendre la courbe, la courbe par son mouvement engendre la surface, et la surface le volume. D'où l'idée que ces engendrement successifs conduisent de la nature potentielle, essentiellement privative, du point géométrique à l'actualité *parfaite* du corps tri-dimensionnel. En ce cas, on dirait que la surface-bord est en puissance par rapport au corps tri-dimensionnel en acte qu'elle limite, contrairement à l'axiome (ABP) (Cf. la discussion de la quatorzième Aporie in *Mel* B5 et *Mel* M2, 1077a27-30). Mais en fait un nouveau facteur intervient : en fonction du caractère ouvert ou fermé de l'«intérieur», la situation change du tout au tout ; le bord de la statue est forme, il est acte par rapport à la matière (informe) de la statue. Par contre il paraît légitime de dire que le bord (la surface) est en situation de puissance par rapport à la statue achevée, car c'en est une partie ($\mu\acute{\epsilon}\rho\omicron\varsigma$).

Si l'on tenait à ordonner par ordre d'«actualité» («ouseités») les figures géométriques élémentaires, je crois qu'on devrait les présenter ainsi : en dimension un

le segment fermé $0 \leq X \leq 1$ est l'ousia pleine et séparée

le point $X = 1$ *bord*, c'est l'*eidōs* de cette ousia

$0 \leq X < 1$ le segment semi-ouvert J : c'est la matière.

On pourrait dire aussi que le segment semi-ouvert J est «en état de privation», privation comblée par l'acquisition de son bord. Mais comme l'a observé Aristote la privation n'est pas l'absence de forme ; c'est plutôt une «lacune» de la forme (Φ II, 193b19-20) qu'on peut représenter par la présence au bord d'un point de fracture virtuel — dont l'actualisation en deux lèvres briserait l'étanchéité de la paroi, et mettrait ainsi l'entité en péril (un homme qui, blessé, perd son sang, est dans un état de privation catastrophique). Ou encore, dans le cas d'un prédateur affamé, c'est un état de métastabilité qui peut revenir à l'équilibre par la rencontre d'une forme extérieure (la proie). La privation peut être aussi une séquelle irréversible d'un choc, la «cicatrice» d'une mutilation organique.

Ceci nous suggère de discuter le statut de l'axiome (ABP) pour les discontinuités organiques (strates de dimension deux, par exemple : membranes ou cloisons).

L'idée essentielle est que, dans la description de processus *transients*, la structuration temporelle du processus physiologique, son déroulement, détermine l'opposition puissance-acte ; généralisant l'exemple donné dans la formule : «La route d'Athènes à Thèbes est la même que celle de Thèbes à Athènes (Φ , III, 3, 202a14)», la même disposition organique peut recevoir, selon le contexte dynamique où elle opère, des interprétations différentes de l'opposition puissance-acte. Par contre lorsqu'on a affaire à un processus «stationnaire» (un écoulement permanent — comme l'est la circulation du sang —), la règle (APB) vaut en général.

Considérons par exemple le cas des membranes cloisons entre deux types de tissu. Certaines de ces surfaces sont en état normal le lieu de transfert de matière ou d'énergie. Mais d'autres surfaces apparaissent inertes et ne sont le lieu d'aucun transfert fonctionnel. Par exemple un os comme le tibia est un anhoméomère limité d'une part par des surfaces d'articulation avec les os contigus (la rotule du genou la malléole du talon). Là le schéma du conflit (de «catastrophe») défini par l'axiome (ABP) s'applique sans difficulté. Par contre la surface latérale du tibia couverte par le périoste, qui n'est le support d'aucune activité fonctionnelle évidente, ne peut recevoir une interprétation qu'en remontant à l'ontogenèse : la nécessité qu'a l'embryon de mammifère de *marcher* lui dicte d'avoir à créer des membres. Seule la dynamique originelle du bourgeon de membre peut expliquer la discontinuité locale de la surface latérale du tibia. D'où la nécessité de revenir à la structure globale de l'être vivant, donc de traiter.

IV. De l'âme ou des âmes.

Car le rapport entre structure et fonction soulève un problème qu'on ne peut pas esquiver. C'est celui de ce qu'Aristote appellera dans le *De Anima* : l'âme. La formule célèbre du *De Anima* 412b, 18-19 : « Si l'œil était un animal, son âme serait la vision », doit être rapprochée d'un modèle de l'organogenèse de l'œil comme dû à l'impact d'un « rayon de lumière virtuel » sur l'ectoderme compétent. On connaît en Topologie un emploi métaphorique du mot âme, comme lorsqu'on dit qu'un tore plein ($D^2 \times S^1$) : (produit du disque D^2 par le cercle S^1 , un anneau) a pour âme le cercle axial ($O \times S^1$), lieu des centres des boules de rayon constant dont l'enveloppe est le tore plein (la surface du tore est l'enveloppe des sphères bords). Je crois qu'il y a là plus qu'une coïncidence accidentelle.

L'âme — support de l'individualité — est en principe un point. Mais ce point n'existe qu'en puissance. Pour se réaliser, il doit s'épaissir et se construire un corps tridimensionnel, et l'organe sera le bord (l'eidos) de cet épaississement. Appelons « link » (avec les topologues) le bord d'un tel voisinage tubulaire. Alors l'acte de l'âme en puissance est localisée dans son link.

Par exemple si l'unité et l'indivisibilité de l'âme de l'être vivant est représentée par un point dans $\mathbb{R}^3$, alors le link de cette âme sera la peau, membrane qui sépare le milieu intérieur vivant du milieu extérieur inanimé. Mais ce serait, je crois, parfaitement illusoire de chercher à localiser ce point (le siège de l'âme!) dans l'organisme. Revenons au diagramme (Δ). Si on veut localiser l'âme de la fonction biochimique qui apporte au corps l'énergie extérieure (par l'oxydation $C + O^2 \rightarrow CO^2$), alors on doit considérer un genre bidimensionnel, à savoir le plan défini par deux variables : x, y

La variable y sous-tend l'opposition

déchet de la combustion		aliment carburant
CO^2	$\Leftrightarrow$	O^2
catabolisme		anabolisme

et la variable x l'opposition Intérieur $\Leftrightarrow$ Extérieur; le link du point « animal » (représentant l'âme) sera le cycle qui, défini à la Van der Pol, donnera le cycle du sang (diagramme Δ). Ce cycle est initialement un cycle d'entraînement du type « roue de moulin » dans le flux énergétique de pyramides écologiques (voir Thom [1986]).

Cet exemple montre que le « link » d'une âme se forme dans un espace abstrait (espace fonctionnel). A partir de l'état quiescent de l'ovule avant fécondation (attracteur ponctuel du métabolisme), l'explosion consécutive à la fécondation fait bifurquer cet attracteur ponctuel

en un attracteur multidimensionnel, où toutes les fonctions organiques universelles sont représentées (ce que j'appelle la blastula physiologique). Puis cette figure se déforme localement en créant des zones catastrophiques qui vont se localiser en différenciations cellulaires, puis en organes spatialement localisés. La déformation de cette figure initiale est décrite par l'application (σ) qui associe à chaque cellule de l'organisme son état métabolique local. La déformation σ_t de l'application σ est modulée selon les grands gradients morphogénétiques de l'organisme tel que le gradient céphalo-caudal. C'est la variabilité (catastrophique) de cette application σ chez l'adulte qui caractérise l'organe. Parfois cette variabilité fonctionnelle n'est pas visible en tant qu'homéomère; ainsi s'explique le fait que certaines limites d'un anhoméomère ne soient pas constituées d'homéomères visibles, par exemple les zones interdigitales décrites au § 3¹¹. Le cerveau est chez l'adulte la projection spatiale de l'unité dynamique originelle du métabolisme de la blastula. Le SNC (système nerveux central) innerve tout l'organisme comme le sang irrigue tous les tissus.

Il faut retirer de tout ceci que l'âme d'une fonction est au mieux réalisée par une strate de *grande codimension* (0, 1, 2); le plus souvent, elle est localisée dans un espace abstrait comme l'espace de genre, et l'organe correspondant est le « link » de cette strate (c'est le bord d'un épaississement)¹².

Il resterait ensuite à exprimer l'interdépendance fonctionnelle des âmes organiques. Il faut voir la formation successive de ces âmes comme une brisure d'une figure initialement continue qui y créerait des arêtes; ainsi naît une stratification d'un espace « fonctionnel » (au sens de la mathématique). Là la dépendance fonctionnelle (la *συνάφεια* aristotélicienne) s'exprime par une relation d'incidence entre les strates de cette

(12) L'aspect géométrique de la relation entre structure et fonction est chose délicate. On sait en Topologie ce qu'on appelle la « dualité de Poincaré ». C'est l'opération qui consiste dans un espace de dimension trois à associer à toute cellule de dimension (i) ($0 \leq i \leq 3$) la cellule « orthogonale » de dimension complémentaire $3-i$. Par exemple dans $\mathbb{R}^3(x, y, z)$, au segment de droite verticale IJ ($I(0,0+1)$, $J(0,0-1)$), on associera le disque orthogonal $z=0$, $x^2 + y^2 < 1$.

On peut dire « grosso modo » que structure et fonction se réalisent en des figures géométriquement duales. Exemple pour $i=2$ (surface) le bord du dual est la sphère S^0 constituée de 2 points : c'est la situation de la membrane séparant deux types de tissus. La fonction est le *transfert* de matériaux (fluides) d'un milieu à l'autre défini par le segment transverse (orienté ou non); la structure est la membrane limitante. Autre exemple : l'articulation entre 2 os contigus dépendant d'un seul paramètre, l'angle plan entre les directions des deux os contigus O_1, O_2 . Alors la structure est la surface d'articulation. Une telle surface (cylindrique) est elle-même *duale* (partiellement) du centre de la rotation ω de O_2 par rapport à O_1 pris comme repère fixe.

Une rotule sphérique permet au contraire une articulation à deux degrés de liberté. L'âme est alors le centre de la sphère d'articulation (cf. la tête du fémur).

stratification. La « moriologie » s'exprime alors comme des contraintes de nature héréditaire portant sur l'application σ qui envoie le substrat matériel (le corps) dans cet espace fonctionnel. Ainsi se trouvent formellement séparées les contraintes universelles de la Physiologie des choix « plus ou moins accidentels » réalisés au cours de l'évolution qui conduisent à la localisation des fonctions en des organes diversement situés ou conformés.

V. Anhoméomères et Finalités.

Je voudrais explorer ici le rapport entre la méthode « diairétique » fondée sur l'emploi d'un questionnaire, et la structure en *arbre* que nous avons relevée chez les anhoméomères (diagramme M).

Cette structure en arbre, reflète en général le processus de leur engendrement au cours de l'ontogenèse. Mais par ailleurs, les diverses parties de l'embryon subissent elles aussi, au cours de leur développement, des scissions, des jonctions, des transformations topologiques et biochimiques diverses. En ce qui concerne les scissions on peut espérer les interpréter fonctionnellement comme correspondant aux réponses d'un questionnaire. Par exemple en Embryologie Vertébrée, on posera d'abord la double question (stade de la gastrulation).

Vais-je pouvoir manger? Oui → Mésotoderme
Non (pas tout de suite) → Endoderme

Puis — Si Oui

Vais-je pouvoir trouver une proie à manger?
oui Ectoderme
non Mésoderme
(pas tout de suite)

Oui

oui Tissu nerveux
non Épiderme

(La proie une fois localisée) vais-je pouvoir l'attraper? Oui

Mésoderme → Somatopleure et

membres locomoteurs

Non (pas tout de suite, plus tard) → Tissu vasculaire et splanchnopleure

(La proie étant capturée et ingérée) Vais-je pouvoir l'assimiler?

oui → Intestin
Non

Si Non

Le déchet non assimilable est-il
solide → Gros intestin
liquide → Reins
gazeux → Poumon

Note. Les déchets liquides, étant d'origine interne, sont traités par des organes issus du mésoderme (néphrotome).

Les parenthèses manifestent la présence de tissus « inducteurs » issus des réponses précédentes ; elles témoignent de processus de jonction dans l'embryologie.

Cet exemple est à rapprocher de la critique faite au livre 1 de P.A. sur la dichotomie platonicienne. Au lieu de chercher à caractériser un animal par une batterie de questions telles que :

L'animal est-il terrestre ou aérien?

L'animal est-il sauvage ou apprivoisé?

Questions qui portent sur des genres indépendants et qui *peuvent être données dans un ordre arbitraire*, il importe au contraire de viser à obtenir par nos questions une description de l'animal. Par exemple, si l'animal est terrestre, demander :

l'animal a-t-il des pattes? Si oui : ces pattes sont-elles solides ou « fendues »? En ce dernier cas : la patte a-t-elle deux doigts ou plus? etc.

Il n'est pas exclu qu'on ne puisse aboutir par la méthode dichotomique platonicienne à une définition correcte (l'homme bipède sans plumes...), mais une telle définition n'aurait guère de pertinence biologique. Il faut, au contraire, organiser une structure en arbre du questionnaire telle que la *ramification du questionnaire simule la ramification (ontogénétique) du substrat*. Ainsi parviendra-t-on à une définition qui soit en même temps une description. On s'approchera ainsi de l'idéal, postulé dans Met Z, 10, d'une définition *dont les parties sont les parties mêmes de l'entité décrite*. Or dans l'arbre des parties du corps, on a par exemple



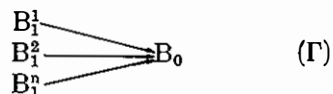
Un questionnaire associé serait :

Voulez-vous repérer une proie?
la voir? → Yeux
oui la sentir → Nez
(une fois capturée) la manger → Bouche

Le gradient vertical de la face s'identifie à un gradient Lumière → Air → Eau → Terre assez semblable au gradient de densité des éléments aristotéliens : Feu — Air — Eau — Terre ; on voit ici la nécessité d'organiser les genres aristotéliens en genres supérieurs (ou hypergenres), par exemple les verbes de sensation (voir, sentir, entendre, toucher) constituent un hypergenre selon la nature de l'élément porteur d'information. (Noter que l'oreille moyenne est d'origine endodermique, comme la muqueuse pulmonaire). La structure de ces « hypergenres » intervenant dans l'embryologie n'est pas connue ; mais ils procèdent

d'une structure en arbre, du type de l'arbre légendaire attribué à Porphyre, les ramifications étant elles-mêmes modulées transversalement par des ramifications d'origine cosmique, comme celle des éléments d'Aristote (les états phasiques de la matière [solide-liquide-gaz] pour les modernes). Ici intervient la classification des organes selon l'analogie (κατ' ἀναλογίαν), qui admet elle aussi ses eidè (cf. CAA p. 152-153). Deux organes sont analogues s'ils procèdent de la même fonction de la physiologie générale, s'ils réalisent le même «âme physiologique» universelle (cf. CAA, pp. 152-153). L'âme d'une telle fonction n'est plus un point isolé «stricto sensu», mais un point dans une configuration actantielle — un chemin transverse à une strate catastrophique selon la théorie des catastrophes. Les Genè qui sont les eidè d'un hypergenre apparaissent par division selon le type phasique des substrats mobiles parcourant le chemin (ou une modulation morphologique du schéma dynamique lui-même). Voir à ce sujet CAA, pp. 152-53.

Il est clair que les finalités sont elles-mêmes organisées en arbre. En vue de réaliser un certain but (B_0), il peut être nécessaire de réaliser des buts préparatoires (B_1^1), (B_1^2)... dont les effets concourent à la réalisation de (B_0), soit symboliquement :



et ceci pourra s'itérer, donnant lieu ainsi à un graphe (Γ) dont le but ultime est la perpétuation de l'espèce animale envisagée. (Aristote parle de συνάτια pour décrire de tels moyens auxiliaires). Toute l'embryologie peut être considérée comme la remontée de ce graphe à partir du but ultime (B_0) — l'état de l'œuf après fécondation — vers la totalité des buts préparatoires extrêmes*. L'axiome fréquent chez Aristote, τῇ γενέσει ὕστερον, τῇ φύσει πρότερον (Φ VIII, 261a13-14) : premier selon la nature, dernier selon la génération, exprime simplement que plus une fonction est biologiquement fondamentale, plus elle nécessite de fonctions et d'organes préparatoires, plus, par conséquent, elle se réalise tardivement.

Dans cette manière de voir il existe un isomorphisme entre le graphe du questionnaire fonctionnel qui interprète les grandes scissions de l'embryologie, et les scissions de l'embryon lui-même en ses grandes différenciations (ectoderme, mesoderme, endoderme) : là le questionnaire ne met en jeu que la physiologie. Par contre dès qu'interviennent les éléments non propres à l'Ego, par exemple des contraintes dues aux éléments (Air, Eau...) du monde extérieur, alors les scissions correspondantes créent des différenciations, et par la suite des jonctions

(*) Une fois les scissions réalisées, on a une période ultérieure de jonctions réalisant les connexions organiques fonctionnellement nécessaires, période de redescende vers B_0 .

appropriées... Il est certain que le système nerveux reste la manifestation organique de l'unité originelle de l'«âme» éclatée vers la périphérie. Il y a dans cette vision de la matière du genre qui s'écoule vers les eidè¹³, comme la chair (initialement indifférenciée) de l'œuf se différencie en spécialisations «cellulaires» distinctes — elle-même analogue à la ramification langagière des anhoméomères — une analogie dont (peut-être) Aristote fut conscient. Mais alors on ne pouvait plus compter sur la seule scission dichotomique binaire¹⁴ pour représenter les faits, et justifier une théorie de la quiddité causatrice de toute entité qui fût accessible grâce au seul Logos. Les critiques qu'Aristote adresse, au Livre I de P.A., à son maître Platon, sont en fait des critiques qu'il s'adresse à lui-même.

Je voudrais en conclusion présenter quelques réflexions sur la finalité aristotélicienne. On en a fait une objection fondamentale à la science aristotélicienne qui serait ainsi en opposition totale avec la science de notre temps. Je crois qu'on a fait là à Aristote un mauvais procès. En effet la finalité aristotélicienne n'est jamais absolue, elle ne parvient jamais avec une totale certitude à son but. C'est une finalité valable *ὡς ἐπὶ τὸ πολὺ*, en contexte normal ; combien de fois trouve-t-on sous la plume du maître la restriction : la fin se réalisera, s'il n'y a pas empêchement, *ἂν μὴ τι ἐμποδίζῃ*, Φ II 199a8-11. On sait que dans De Generatione et Corruptione, Aristote va jusqu'à dire que la finalité n'agit pas par elle-même : *Τὸ δ' οὐ ἕνεκα οὐ ποιητικόν* (324b, 14) ; personnellement, je crois qu'il est difficile de faire une théorie de l'embryologie sans évoquer une certaine causalité *formelle*, s'exprimant sous forme de la présence de champs morphogénétiques. C'est dire que le milieu vivant va présenter des entités locales qui, à un certain moment critique du développement (*ἐπ' ἀρχὴν ἔσθ'*) (Φ VIII, 7, 261a14) vont entrer en privation ; elles chercheront à pallier cette privation en essayant de trouver dans leur environnement une forme prégnante (comme la forme de la proie pour le prédateur affamé) qui va déclencher en elle le

(13) Assez curieusement, Aristote associe dans P.A. II, 647a3-5 les homéomères aux fonctions de la sensibilité. Ceci n'est pas absurde si on veut bien assimiler la rétine de l'œil, par exemple, à une surface de «contact» entre la chair et le diaphane. Aristote dit d'ailleurs que la vision est une partie de l'œil (Φ IV, 211b2).

(14) Dans le De Generatione et Corruptione II, 330a30-35 Aristote définit les quatre éléments par un procédé de dichotomie binaire portant sur une *materia prime* :

	Sec	Humide
Froid	Terre	Eau
Chaud	Feu	Air

Il se félicite de cette trouvaille ; non sans raison, car il faudra attendre le cercle de Prague et R. Jakobson pour trouver, avec la phonologie (le phonème défini par ses traits différentiels) une construction analogue — celle qui devait engendrer le structuralisme moderne. On peut se demander si cette découverte est antérieure ou non au livre I de P.A.

mouvement comblant cette privation. On peut d'ailleurs envisager ce processus sous forme globale, affectant un certain ensemble de ces entités (le plus souvent des cellules). Il y a lieu de penser qu'alors — en contexte normal — le processus va s'effectuer suivant une dynamique structurellement stable (compte tenu des contraintes devant satisfaire les privations locales). Ainsi obtiendra-t-on un champ morphogénétique se déployant dans un certain ouvert U_i de l'espace-temps, où la morphogenèse se déroulera conformément à une carte locale susceptible de subir des déformations quantitatives (mais non qualitatives!) qui peuvent être importantes (phénomènes dits de régulation). L'ontogenèse ne sera plus alors qu'une concaténation de tels champs morphogénétiques, aboutissant à la fin à la construction de l'organisme achevé. Dans une telle vision, le seul élément quelque peu suspect est la nature physique (ou chimique?) des coordonnées constituant les cartes locales des champs. Il ne fait guère de doute qu'Aristote acceptait l'existence d'agents «translocaux» susceptibles de transmettre des effets «à distance», i.e. à une vitesse très grande. Tel est le cas de la lumière, propagée par cet élément non local, le diaphane⁷. L'hypothèse du «contact» (Φ IV 9-10) nécessaire à l'interaction entre deux entités, n'est guère restrictive, s'il s'agit du «contact» entre une matière sensible étendue localement, et une «matière» subtile, invisible et translocale s'étendant extrêmement loin. Aristote, dans son argumentation contre l'existence du vide, observe (avec raison) que là où on dit qu'il y a le vide, la lumière se propage (Φ IV, 214a10). Ce problème, qui fut celui de l'éther au XIX^e siècle, n'a été résolu que formellement par la Physique Moderne, qui postule des symétries globales de l'Univers — sans spécifier la nature des agents physiques qui réalisent ou supportent cette symétrie. D'ailleurs Aristote a manifesté son embarras pour expliquer la *phora* d'un corps vers son lieu naturel (qui peut en être éloigné) (Φ VIII, 255a-b). Tout ceci fait qu'il n'y a pas plus de magie dans l'existence d'un champ morphogénétique en Embryologie que dans l'existence d'une loi mathématique d'évolution en Physique. Enfin pour lui le Nous pathétikos et le Nous poiétikos décrits au De Anima III 5 sont des agents translocaux, ni localisés ni personnalisés; ce dernier est comparé à la lumière, qui rend visibles en acte les couleurs qui sans lui resteront invisibles. Car on ne saurait imaginer une Physique sans «entité exploratrice» susceptible de contrôler son environnement — comme le repère cartésien présuppose un appareillage de mesure des événements qui se passent dans ce repère, et comme l'animal vigile a une représentation permanente de son environnement.

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